JPRS-CST-84-012

23 April 1984

China Report

SCIENCE AND TECHNOLOGY

FBIS FOREIGN BROADCAST INFORMATION SERVICE

NOTE

JPRS publications contain information primarily from foreign newspapers, periodicals and books, but also from news agency transmissions and broadcasts. Materials from foreign-language sources are translated; those from English-language sources are transcribed or reprinted, with the original phrasing and other characteristics retained.

Headlines, editorial reports, and material enclosed in brackets [] are supplied by JPRS. Processing indicators such as [Text] or [Excerpt] in the first line of each item, or following the last line of a brief, indicate how the original information was processed. Where no processing indicator is given, the information was summarized or extracted.

Unfamiliar names rendered phonetically or transliterated are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear in the original but have been supplied as appropriate in context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by source.

The contents of this publication in no way represent the policies, views or attitudes of the U.S. Government.

PROCUREMENT OF PUBLICATIONS

JPRS publications may be ordered from the National Technical Information Service, Springfield, Virginia 22161. In ordering, it is recommended that the JPRS number, title, date and author, if applicable, of publication be cited.

Current JPRS publications are announced in Government Reports Announcements issued semi-monthly by the National Technical Information Service, and are listed in the Monthly Catalog of U.S. Government Publications issued by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Correspondence pertaining to matters other than procurement may be addressed to Joint Publications Research Service, 1000 North Glebe Road, Arlington, Virginia 22201.

y

JPRS-CST-84-012

23 April 1984

CHINA REPORT

SCIENCE AND TECHNOLOGY

CONTENTS

LIFE SCIENCES

NATIONAL DEVELOPMENTS

ACCELERATE TRAINING OF BIOCHEMISTRY PERSONNEL

Shanghai SHENGMING DE HUAXUE [CHEMISTRY OF LIFE] in Chinese No 5, 15 Oct 83 pp 1-5

[Article by Zhang Longxiang [1728 7893 5046], Beijing University]

[Text] During the 12th CPC Congress, education was established as a strategic key point to realize China's modernization. To carry out this most important strategic decision, we must adopt effective measures to turn around the ill-matched situation between education and the needs of the national economy and social development. The development in educational undertakings and the accelerated cultivation of talents in various fields of national construction should be placed in the most prominent position in our current considerations. A pronounced shortage of professional expertise can be observed in every department and in every region. Our country is in dire need of producing many well-trained personnel. We can not wait any longer in the training of biochemistry personnel. Being an in-demand specialist vocation, the biochemistry field demands personnel whose magnitude far exceeds what the current system can supply. We must speed up the training system by taking effective measures during the course of expanding the scale of higher education.

I. As an independent special field of study, biochemistry started to train personnel in 1956. At that time, the first specialized field of biochemistry was set up under the department of biology in Peking University. Thereafter, universities and teachers colleges set up the specialized field of biochemistry under the biology department to train students. In 1963, at the recommendation of the Second National Biochemistry Symposium, the first specialized field of biochemistry was established under the chemistry department at Jilin University. In addition, a few agricultural, medical and engineering colleges began to offer specialties, such as the biochemistry of plant physiology, the biochemistry of animal physiology, biochemical pharmacy, biochemical engineering, etc., to college-level students. The research institutes of these universities, the Chinese Academy of Sciences, the Chinese Academy of Medical Sciences and the Chinese Academy of Agricultural Science were also training graduate students in biochemistry.

Higher education was one of the disastrous areas during the 10-year turmoil. The specialized field of biochemistry also suffered. After the smashing of the gang of four rectification work began and became intensified after the

3d Plenary Session of the 11th CPC Congress. Teaching and scientific research work in biochemistry were restored and developed. Biochemistry education now has a sound basis. Since 1982, two classes of biochemistry majors have graduated. We were delighted to see the restoration of the graduate student system in 1978 and the establishment of academic degree programs which opened up a path for the independent training of advanced biochemistry specialists in China. Institutions of higher education and scientific research units have conferred the masters degree on two groups of graduate students. The Biophysics Institute of the Chinese Academy of Sciences conferred the first doctoral degree on a researcher specializing in molecular biology.

Biochemistry specialties have been set up in 12 universities, normal universities and chemical engineering colleges which together admit approximately 400 new students annually. In agricultural, medical and engineering colleges, 15 specialized fields closely related to biochemistry have been established to train students. Approximately 700 new students are admitted each year. There are 65 specialties in institutions of higher education and scientific research units that are qualified to confer masters degrees in biochemistry (or related fields) and 16 confer doctoral degrees. Approximately 200 graduate students are admitted to biochemistry (or related fields) annually. There has been a definite increase in the number of college and graduate students enrolled; however, the need for biochemical personnel for future modernization construction is inadequate.

II. Educational undertakings have long cycles and far-reaching effects. With regard to the training of biochemistry personnel, we need to study and plan so that the number of students enrolled, the rate of development, and administrative structure meet the needs of the economic construction and social development in China. The forecast on the size of specialized personnel needed and the drafting of training plans and now being made by concerned departments. At present, we do not have a sound figure which could tell us the number of specialized biochemical personnel needed in the coming 10 or so years (for example, to year 2000). However, judging from the facts gathered in individual investigations, the number of students currently enrolled and rate of development will not meet future needs.

For example, the food industry is an under-supplied specialized trade. The food industry has greater development and personnel needs during the Sixth 5-Year Plan and the Seventh 5-Year Plan periods. Statistics shows that among the 1.23 million workers in the food industry, only 15,000 or 1.26 percent are high- or middle-level technicians. Ignoring the developmental factor for a moment, we will need 12,300 people to raise the percentage of middle- and high-level technicians from 1.26 to 2.26 percent during the Sixth 5-Year Plan period (the 2.26 percent is quite low in an industrial system). Many advanced technicians in the food industry are college graduates with biochemistry or related majors. In light of the number of students currently enrolled in biochemistry and related fields, the total number of university graduates will be at most 5,000 during the Sixth 5-Year Plan, this will not meet the need even if all of the graduates were to be absorbed by the food industry.

The above example shows the needs of just one among the various light industries. The needs of agriculture, animal husbandry, fishery, the medical and health professions, education and science, science and technology administration and management, etc., have not been considered. In short, in light of the number of students currently enrolled and rate of development, the training of biochemistry personnel will not meet the demand of existing enterprises and services. The training of specialized personnel should not only consider short-term demands, we should anticipate long-term needs, and we should not only consider the needs of production and construction but estimate the developmental trends of modern science and technology. If we consider new industries such as bioengineering and biotechnology genetic engineering, enzyme engineering, cell engineering, the production of single-cell protein and bioenergy sources, etc., the need for biochemical specialists greatly increases.

III. The demand for biochemistry personnel is great, but training is still a weak link. We need effective measures to speed up the training process.

What are the guiding principles for speeding up the training of biochemistry personnel? First, we should proceed from the actual conditions in China, the actual needs of our modernization construction, the developmental trends in science and technology, and sum up the historical experience of setting up biochemistry specialties in institutions of higher learning, and successful foreign experience, before drafting plans for accelerating the training of biochemistry personnel. The plan should be compatible with our economic construction and social development. Second, biochemistry personnel can be trained at various levels, in many forms and under different regulations. Different construction projects require workers of different caliber. As far as level is concerned, some require personnel with graduate-level training, some require college graduates and others require workers with vocational school or technical secondary school training. In forms of running the schools, television or broadcasting universities, short-term vocational universities, correspondence universities and after-work universities could be established to offer biochemistry courses and train more personnel.

In line with the above spirit, the following measures may be taken to speed up the personnel training process:

1. Fully develop the potential of biochemistry in universities, under the prerequisite of ensuring quality and based on the need, more students should be enrolled. Some qualified institutions may broaden the scope of specialties by adding applied biochemistry specialties or conducting short biochemistry training sessions. Biochemistry is an empirical science, laboratories should be built to strengthen student training. Those chemistry departments in universities with proper facilities may add biochemistry specialties. Within chemistry specialties, an elective biochemistry group may be added. General biochemistry and biology courses could also be added. Students taking the biochemistry elective may write B.S. theses in this field. This is a shortcut method to broaden the training of biochemistry specialists. Agricultural, medical, engineering and other biochemistry-related disciplines should develop potential by increasing enrollment

and sponsoring short training sessions to cultivate college-level specialists. A few qualified institutions of higher learning may set up new specialties in genetic engineering and enzyme engineering to cultivate needed personnel in these newly developed areas.

2. Enlarging enrollment in biochemistry specialties for graduate students to speed up the training of high-level personnel. The high-level S&T personnel in our institutions of higher learning, scientific research organizations and industrial departments is generally weak, aged and substandard. Few can do independent research. To remedy the situation, united regional entrance examinations can be sponsored by institutions of higher learning, scientific research organizations and industrial departments to admit more graduate students, and basic courses and specialty courses at the graduate-level (including laboratory experiment) can be offered. Graduate students can spend the first 2 years concentrating on their studies, after passing a uniform test, they will return to their units to work on dissertations. Dissertation committees can be organized within a unit or in cooperation with other units. Those who successfully pass will be awarded masters or doctoral degrees.

3. Other universities, such as television and broadcasting universities, correspondence universities and after-work universities, may set up biochemistry courses. Employed workers and youths may enroll. Experienced teachers from biochemistry specialties of higher institutions can be invited to lecture and offer laboratory classes evenings or Sundays to attract students. After examination, those qualified students will be issued diplomas showing their level of academic achievement.

4. Training mid-level personnel by expanding secondary technical schools. Biochemistry engineering and applied biochemistry specialties can be added in secondary technical schools to draw more students to the field.

More and more comrades have begun to realize the importance of personnel training in our socialist modernization tasks. The demands for biochemistry specialists are urgent. We workers in the biochemistry field are facing an honorable yet difficult mission. We must encourage enthusiasm and work hard to create a new phase in biochemistry higher education, making our proper contribution to the training of biochemistry personnel.

CSO: 4008/119

REMOTE SENSING: NEW TOOL FOR CHINA'S GEOLOGISTS

Beijing ZHONGGUO DIZHI [CHINA GEOLOGY] in Chinese No 1, 13 Jan 84 pp 18-23, 17

[Article by Yang Guangqing [2799 0342 1987] of the Geophysical and Geochemical Exploration Bureau, Ministry of Geology and Mineral Resources: "Foster the Superiority of Remote Sensing, Create a New Situation for Remote Sensing Geology Work"]

[Text] Remote sensing geology work in geological departments began on a wide scale after remote sensing technologies were made one of the five major new technologies for key development by the Ministry at the Shanghai Geology Conference in 1978. In the past several years, under the leadership of the Regional Survey Bureau and the Geochemical Exploration, Petroleum, Hydrogeological and other special bureaus of the former Ministry of Geology, a great deal of work has been done in organizational structure, personnel training, technical equipment, popularizing and extending remote sensing technologies, and in extending applied results. This is especially true under the impetus of the decision on establishing remote sensing geology stations in 1979, the Report-Back Conference on Work in Remote Sensing Geology Stations in 1980, the formulation of the "Technical Requirements for Application of Remote Sensing Images in Conducting 1:200,000 Regional Surveys (Trial)" and several academic conferences, all of which have led to major development of the scope of remote sensing geology work in the Ministry.

1. Good results have been obtained in geological applications, and it is becoming a new and useful method in certain areas of geological work.

Experience in recent years has proven that remote sensing technologies can provide important data for speeding up the pace of regional geological investigations, for research on geological structures, for reducing the size of mineral exploration target areas and for determining the scope of energy surveys. Investigations in hydrogeology, engineering geology and environmental geology can also provide obvious results.

In the area of regional geological surveys, good results have been obtained in recent years in the application of remote sensing photographic data in combination with 1:200,000 scale regional geological surveys, and black-and-white aerial photographs are being widely used in actual work by

regional survey teams. In areas with a high degree of geological research, data from aerial and Type II photographs was revised for early publication of a 1:200,000 regional geological survey map, with excellent results.

In the area of surveying for metallic and nonmetallic minerals and energy deposits: Along with full utilization of all types of geological S&T information, there is indirect exploration for minerals which usually involves an analysis of the special effects and characteristics of remote sensing photographs, research on the structure of control minerals, searches for mineral-bearing strata and demarcation of the scope of the basin to reduce the target area of mineral exploration, and forecasting sections with possible mineralization. In addition, several achievements have been made using remote sensing photographs for evaluation the structural stability of factory, station and dam site projects, for monitoring environmental pollution, and for research on the geology of disasters.

2. The sphere of applications of remote sensing technologies has been expanded.

Actual work has shown that good geological results can be obtained by applying remote sensing techniques in the geological sciences, and that there are broad prospects for their application in all sectors of the national economy. In recent years, apart from undertaking their remote sensing tasks for our ministry system, the Geological Remote Sensing Center and several geological remote sensing stations have also undertaken remote sensing projects for different purposes for several industrial departments and scientific research units. Some examples include: surveys for uranium ore, gold ore, and peat, selection of railway lines, surveys for water conservancy construction and beach conditions, environmental pollution surveys, agricultural surveys, urban planning, and so on.

3. A large number of scientific research results have been improved, and there has been a great deal of extension work.

More than 50 special research topics based on the needs of actual production have been completed by the Geological Remote Sensing Center, geology and mineral resources bureaus (and departments) in all provinces (municipalities and autonomous regions), remote sensing groups in the petroleum and marine geology and hydrogeology systems, geological schools and colleges, scientific research units, and so on. They provided over 100 reports and articles, 6 of which have been presented at international geological research conferences.

Many units have compiled special geological maps and representative aerial and satellite photograph albums to popularize and extend remote sensing geology techniques. Examples include the DIQIU ZIYUAN JISHU WEIXING XIANGPIAN TUJI [Satellite Photograph Atlas of Earth Resources and Technologies] compiled by the Geological Remote Sensing Center and a 1:6,000,000 scale linear structural map and guidebook for the Chinese mainland. The geological and mineral resources bureaus and remote sensing stations in Liaoning, Gansu, Henan, Guizhou and other provinces have compiled 1:500,000 linear structural

provincial maps or illustrations and explanations of geological structures on 1:500,000 to 1:1,000,000 scale satellite photographs. Remote sensing stations of the geology and mineral resources bureaus in many provinces (municipalities, autonomous regions) have attained a certain level in compilation of albums of typical aerial photographs and interpretation standards for their province (or region). Those publications in the editing stage that are to be published include "Collected Articles on Remote Sensing of Hydrology in the North and Karst in the South" and an album of typical photographs, and an "Atlas of Aerial and Satellite Photographs or Typical Geological Images in the PRC."

In order to adapt to developments in remote sensing geology work and to meet departmental needs, many production and scientific research units have actively developed and produced remote sensing instruments and equipment that are now in urgent demand. For example, the Research Team on Geological Techniques and Methods for Hydrogeological Engineering cooperated with related units to develop the Model JH-1 aircraft-mounted infrared scanner which has been tested in hydrogeology and railroad surveys. The Integrated Research Team of the Shaanxi Province Geology and Mineral Resources Bureau cooperated with the Northwest Industrial University to convert a prototype airplane used as an artillery target into a small remote control aircraft for use in aerial remote sensing and geophysical exploration. It has already been used in useful experimental research work like surveys of soil erosion conditions on loess plateaus. The Beijing Geological Instruments Plant has developed and produced Model TXY-1 Remote Sensing Photographic Diazotype Equipment and is preparing to extend its application. The Jiangsu Province Geology and Mineral Resources Laboratory has developed the Model WXCH-79-1 Satellite Photograph Color Synthesizer which is being used in some units. The Geophysical Research Institute is now actively developing a dual-channel spectral radiometer.

4. A specialized remote sensing contingent has been built up.

For development of remote sensing geology techniques, the Ministry in recent years had not only sent people abroad for investigation and study, but has also imported basically-outfitted special remote sensing airplanes, aerial remote sensing instruments, technology and equipment for digital map processing and automatic developing and printing. These have provided the required material and technological conditions for beginning remote sensing geology work in the Ministry. In organization and construction, the Ministry has established a special remote sensing geology contingent with a certain technical level and actual work experience. Beginning in 1979, 27 remote sensing stations (or groups) have been established in all provincial (municipal and autonomous region) geology and mineral resources bureaus (departments). According to preliminary statistics, the Geological Remote Sensing Center had undertaken a total of 2,340 hours of flying time in aerial remote sensing tasks by the end of 1982. The major part is various types of aerial photographs, along with some aerial infrared scans and aerial multispectral scans. In addition, the Ministry's Petroleum and Marine Geology System and Hydrogeology System have established dozens of remote sensing groups. Geological colleges and schools have established 4 remote sensing

geology research offices and remote sensing technology applications research offices.

It can be seen from the above that remote sensing techniques have certain applied results and roles in geological work, in construction of the national economy and in other spheres, and should be extended actively. Because they are fairly complex new technologies, however, we must continually explore the process of practice and understanding of the conditions required for their application and questions of how to organize and manage them in order to summarize a set of administrative methods as soon as possible.

The main problems now are: the geological mineral exploration results and economic and social usefulness of remote sensing are not sufficiently apparent. Many successful applications have not been popularized and extended, and the scope of their application is too limited. There has not been adequate application, research and explanation of remote sensing data, and applications levels have not been improved. The reasons for this situation are: 1) the organizational structure of remote sensing stations (and groups) in the geology and mineral resources bureaus (departments) of many provinces (municipalities and autonomous regions) has not been improved, and many of the remote sensing stations (groups) have not fully undertaken the four tasks, but instead only undertake one task and do a bit of special research work; 2) technical management work is relatively weak, and there is no technical management work system that is united from top to bottom. There is a lack of effective guidance and assistance for the remote sensing stations (groups), and the standards and systems for promoting applications of remote sensing geology have not been formulated and perfected; 3) there is insufficient concentration on and extension of some new technologies. For example, not many people know how to use computerized map processing techniques and the fees are too high, which discourages their extension; 4) the demands on existing aerial photography procedures are complex and there are too many beauracratic steps.

II.

Comrade Sun Daguang [1327 1129 0342] pointed out at the National Conference of Bureau Chiefs of Geology and Mineral Resources Bureaus in 1983 that: "The overall goals of struggle for geology work up to the end of this century are: to strive to improve the results of geological mineral exploration and the economic and social benefits, to raise the level of modernization in geology work, and to prepare the mineral resources and geological information needed for quadrupling the total national value of industrial and agricultural production and for continued development into the next century." The application of remote sensing methods is one aspect of modernization of geological work. It can be expected that strengthened remote sensing geology work and efforts to extend remote sensing methods in geological mineral exploration work will come to be very important for achieving this overall goal of struggle.

Remote sensing geology involves the application of remote sensing techniques in geological work. Like all other exploration methods, it has capabilities

and limitations. Applications should emphasize the advantages and avoid the disadvantages. The advantages of remote sensing are that it provides abundant macroscopic and directly perceivable information, obtains rapid and inexpensive data (when used properly), and can be used for research on trends. Its disadvantages are that the remote sensing images basically reflect only surface conditions and can only use ground surface information for indirect inferences of subsurface conditions; it is easy to suffer from restrictions and interference from surface and environmental factors. Based on practical experience over the past several years, several types of relationships must be dealt with in application.

1. The relationship between direct and indirect mineral exploration and between mineral exploration and other applications in geological work.

When evaluating the effectiveness of any method in geological work, it is often easy to overemphasize mineral exploration, especially in the role of direct mineral exploration. One advantage of remote sensing is macroscopic research over a large area. It is thereby better suited to exploration and research in regional geology, hydrogeology, engineering geology, environmental geology and other areas. Although it can be used under favorable conditions for research on fairly small partial targets, there are few examples in the area of mineral exploration throughout the world where remote sensing has been used successfully for direct mineral exploration. They are used mostly for research on the geological structure of control minerals and mineral deposits, for searches for mineral bearing strata, and for research on forecasting mineralization in prospective regions (or zones). These indirectly aid in narrowing the mineral exploration target areas. Moreover, mineral exploration should not be limited to metallic mineral deposits. Attention should also be given to surveys for coal, petroleum and other energy sources and for non-metallic mineral deposits.

2. The relationship between applications in geological work and in broader economic construction.

Comrade Zhang Tongyu [1728 0681 6877] pointed out in the Remote Sensing Stations Report-Back Conference in March 1980: "Remote sensing work should expand its range of services, such as having aerial geophysical exploration brigades provide environmental protection and agricultural zoning services. This in turn can lead to major developments in remote sensing." The term "environmnetal protection" can be understood as an expansion of the sphere of geological work. "Agricultural zoning" is a requirement of national economic construction. Comrade Xia Guozhi [1115 0948 3112] stressed recently that remote sensing should be opened up and given wider application. Any new technology must provide results and real benefits before it can become firmly established, gain support and be developed. The scope of work in the early stages of development cannot be overly restricted to the point where one's hands are tied. If it is needed for national economic construction and for society, and if remote sensing techniques can obtain good results, then we should become involved in any task for which we have the conditions. We can improve our abilities through actual work. We should undertake many types of resource surveys (for agriculture, forestry, animal

husbandry, fisheries, etc), surveys of land utilization, urban planning and coastal zones, surveys for preliminary engineering in construction projects, and investigations of disasters.

3. The relationships between popularization and improvement and between specialized contingents and mass utilization.

Remote sensing methods have become quite mature in some spheres of application and can be used over a broad area. For example, satellite images have been used for small-scale regional geological surveys and for research on geologic structures. Black-and-white aerial photographs have been used for 1:200,000 and 1:500,000 scale regional geological surveys and geological surveys of mineral deposits. Aerial infrared scanning has been used for measurement of water surface temperatures and for surveys of thermal pollution of water systems. These methods can basically be used, but some of them still require continued research on questions of conditions, including whether or not they are economically worthwhile. Examples of such methods include the use of satellite images for 1:200,000 scale regional geological surveys, the use of color (and color infrared) aerial photographs for regional geological mineral surveys at 1:50,000 or larger scales, for hydrogeology and engineering geology surveys, and for urban surveying, environmental monitoring, agricultural and forestry surveys, and so on. Another example is aerial infrared scanning for cold and hot springs, old river channels, etc. Some methods are still in the testing and research stages, such as application of multispectral scanning imaging, application of spectral testing, and so on. Great efforts should be made to extend effective methods and their spheres of application to form a productive force and truly foster their economic benefits. We should also strengthen testing and research on methods and spheres which have not yet been perfected.

In actual work, remote sensing often is one of many methods used, and the information it provides can be used in many areas. For this reason we should stress giving full play to its role and the comprehensive utilization and many benefits of information from remote sensing in the comprehensive application of such methods. Although we have a fair-sized contingent of specialists, their technical strengths are completely inadequate for achieving real results in giving full play to the role of remote sensing data in all spheres. One person cannot have such broad specialized knowledge or be deeply involved in all spheres of application. We should, therefore, stress the active use of remote sensing information by all specialists involved in geology, regional surveying, hydrogeology, engineering geology, geophysical and geochemical exploration and other fields. They should gradually make this information one of the common measures used in their own specialty. The correct principle is to integrate application by specialized contingents with application by the broader geological (or user) contingents.

Therefore, the future policies for remote sensing geology work are: to give play to the advantages of remote sensing technologies, to make a great effort to popularize and expand their utilization, to improve levels and

strive for practical results, and to create a new situation in remote sensing geology work. We should strive during the period of the 7th Five-Year Plan to bring the application of common remote sensing techniques up to advanced world levels.

In the area of task distribution, we should take geological mineral exploration work as the center and make overall arrangements for work in the following areas:

1. Continue to make great efforts to popularize the application of remote sensing geological techniques in regional geological surveys on all scales.

Remote sensing geology techniques are a basic measure for accelerating the pace of regional geological surveys and for improving the quality of regional geological survey charts. Provision and preliminary interpretation of remote sensing data should be at the forefront of large-scale geology work, and they should penetrate regional survey work beginning to end. We should universally make use of satellite photographs and black-and white aerial photographs and actively test color and color infrared aerial photographs in regional geological surveys at 1:1,000,000, 1:200,000, 1:50,000 and other scales. Provinces (and autonomous regions) in the high elevation frigid border areas of the country should use them first of all in small-scale regional geological survey work. Before 1990, work tasks should focus on filling in blanks and complementing blank charts from medium and small-scale regional geological surveys. The Qinghai-Xizang region should first concentrate on coordinating and completing 1:1,000,000 scale regional geological surveys of the Xizang region, and should also consider coordinating with and completing regional geological survey tasks in the Sanjiang region of the Tanggulashan Mountains. The eastern regions of the country first of all should link up with prospective mineral exploration regions or key development regions in the national economy, and actively begin using remote sensing methods for remeasurement or revision of the small and medium-scale regional geological survey charts of their province that were published earlier within their particular province. In the next 3 or 4 years in 1:200,000 regional survey work, apart from using existing aerial photograph data, we should also strive to use large-scale high resolution black-and-white photographs and test-use color aerial photographs, to do research on what type of aerial photographs to use in what situations according to economic results, and to provide new technical measures for coordinating with the Ministry on the task of completing 1:50,000 scale regional surveys over an area of 2 million square kilometers by the end of the century. At the same time, attention should also be given to using remote sensing methods for strengthening research work on Quarternary geological surveys and new structural movements.

2. Strive to expand the application of remote sensing technologies in hydrogeology, engineering geology and environmental geology. The results are quite obvious when remote sensing map data is used to solve several problems in hydrogeology, engineering geology and environmental geology, and this is receiving ever-increasing attention. Remote sensing stations (and groups) and remote sensing groups in hydrogeology teams should expand the

application of remote sensing on the basis of existing technical levels. Examples include the demarcation of water-rich zones in regions with water shortages and the location of cold and hot springs, salinized-alkalinized zones, old river channels and so on. Before 1990, there should be coordination to complete medium and small-scale regional hydrogeological surveys in the Qinghai-Xizang Plateau and in the arid and semi-arid regions of the North, for opening up resource and environmental surveys in the greater Northwest, for research on examining programs for the south-to-north transfer of water, and other tasks. In areas with the proper conditions, we should make use of the advantages of remote sensing techniques according to the needs of society and actively participate in research on landslides, desertification, salinization-alkalinization and other natural disasters. We should undertake preparatory engineering surveys for key national factory, station and dam sites, evaluate their structural stability, do environmental pollution monitoring, and so on.

3. According to geological conditions, we should adapt to local situations to resolve certain concrete problems in geological mineral exploration in the various forms of prospecting for mineral resources.

Given the current situation, we should stress the application of remote sensing data in indirect mineral exploration and adapt to local conditions to resolve certain geological mineral exploration problems according to concrete geological conditions. For example, based on the special characteristics of images of control mineral structures and mineral-bearing strata in known mineral deposits, we can explore for mineral in geologically similar regions (or zones). In research on key regions (or zones) of prospective mineral formation, we can give attention to making use of remote sensing images, regional geological data and data from geophysical and geochemical exploration to strengthen research on the geological conditions of control minerals and mineral formations and on the special imaging characteristics that are particular to certain stratiform and strata-controlled metallic and non-metallic mineral deposits. This can further reduce the target areas for mineral exploration work. Data from remote sensing charts can be used in energy surveys for research on special regional geological characteristics over a large area, to integrate with other methods for continued research on the relationship between annular images and petroliferous structures, and to demarcate directly the distribution and scope of coal-bearing basins and peat.

4. Actively serve the needs of economic construction and society, develop systematic map publishing work.

The experience of the Comprehensive Survey of Agriculture and Forestry in Shaanxi and the preliminary experiences of the Comprehensive Aerial Remote Sensing Survey of Beijing have shown that actively publishing a series of maps for a province (municipality, autonomous region) or a natura or economic region on the basis of comprehensive information over a large area that is supplied on remote sensing images is a method with much promise. There are, for example, imaging geology maps, Quarternary geological maps, geomorphologic maps, hydrogeologic maps, engineering geology maps, vegetation

distribution maps, agricultural geology maps, land utilization maps, forest distribution maps, urban planning (afforestation, horticultural, construction, etc) maps, environmental pollution survey maps, and so on. Moreover, there can be integration with actual work needs to carry out replacement, revision or trend analysis of the above maps for a certain period of time. This potentially is an important aspect for giving all-round full play to the superiority of remote sensing techniques in long-term systematic work.

5. Strengthen research on remote sensing methods and techniques and on certain basic theories.

In order to promote the development of remote sensing geology work in China, there should be organized and planned development of experimental research work on remote sensing techniques and methods, on interpretation methods, and on certain fundamental theories. In the process of carrying out aerial remote sensing flights, the Geological Remote Sensing Center should strengthen research on utilization conditions, work methods and interpretation methods, and on spheres of application and their results in aerial infrared scanning and aerial multispectral scanning methods. At the same time, they should also formulate rational procedures for remote sensing geology work and combined programs for all types of aerial remote sensing methods. In the area of geological interpretation, we should gradually move from the current principle of reliance primarily on visual interpretation to reliance on electronics--spectral image processing equipment and digital image processing systems should be more widely used in geological interpretation and functional processing to improve the level of interpretation. More of the technical personnel in the remote sensing stations (groups) of the geology and mineral resources bureaus (departments) in each province (municipality, autonomous region) should be organized to study and make use of the 1^2S101 digital image processing system. Moreover, we should strengthen research on application methods, software and results. Attention should be paid to research on using computers for comprehensive processing techniques and interpretation methods for remote sensing data and geophysical or geochemical exploration data. The remote sensing stations (groups) of the geology and mineral resources bureaus (departments) in each province (municipality, autonomous region) should actively undertake specialized research work adapted to local conditions and based on the technical strengths of their particular unit. For example, in southern provinces (and autonomous regions) with vegetational growth, there can be research on the relationship between the spectral peculiarities of vegetation (abnormalities) in mineralization zones and the distribution of mineral deposits. In northern regions with better exposure, research may be conducted on the rock types related no mineralization and mineral deposits and on the relationship between the spectral pecularities of erosion zones and imaging characteristics. Research may also be conducted on the mechanisms of linear and annular imaging and their significance in mineral exploration, and so on.

In the next 3 or 4 years, we should also concentrate on the spectral characteristics of geological formations in China and studying their relationship to the distribution of mineral deposits. On the basis of gradually establishing the interrelationships between aerial multispectral

data and surface spectral peculiarities, we should stress research on questions of theory and methods in the application of computer processing of survey data on the spectral peculiarities of surface features in aerial or space multispectral data. In order to improve the quality of charts of the results of geological interpretation, we should also strengthen research on methods and techniques of mapping.

In addition, during the process of extending the application of remote sensing technologies, we should pay close attention to construction ground receiving stations for our nation's satellites, to the developmental trends of side-looking radar and other macrowave remote sensing technologies and their remote sensing methods and mapping techniques in China, and we should waste no time in applying them in the Ministry's remote sensing geological work.

III.

In order to further promote the development of remote sensing geological work, we should concentrate on the following items of work:

1. Perfect the organizational structure of remote sensing geology.

We must strengthen construction in the Geological Remote Sensing Center and transform it into a truly effective applications and development center for remote sensing techniques in the Ministry. The Center should provide technical guidance and training for the remote sensing stations (groups) of the geology and mineral resources departments in all provinces (municipalities, autonomous regions), and should also work hard to provide technical services. Moreover, it should also engage in a certain amount of technical and management work when authorized to do so by the Ministry.

The geology and mineral resources bureaus (departments) of each province (municipality, autonomous region) should perfect their remote sensing geology stations and strengthen leadership of them. They should continue to adhere to the basic tasks and required decisions of the documents related to remote sensing stations that were issued by the former Ministry of Geology. The remote sensing stations should not only undertake tasks and research topics for geological applications, but should also be involved in organizational management, technical training, planning and guidance work for remote sensing geology work for each province (municipality, autonomous region), and should play their role as a center for remote sensing geology work in their province. Remote sensing stations should have small numbers of highly-trained personnel. In the areas of applications spheres and technical developments, there should be a certain amount of specialization according to local conditions depending on the tasks and situation in each province (municipality, autonomous region). In each region, regional survey teams, geology teams, geophysical exploration teams and geochemical exploration teams should first of all emphasize popularization and application so that every geological, geophysical and geochemical exploration worker has not only studied but also knows how to apply remote sensing data in their own work. Several remote sensing groups can also organize to further centralize

research, extension and application. This will form a tri-level organizational system for remote sensing geology work which links the Ministry, provincial bureaus and the teams.

2. We should pay attention to intellectual development and strengthen technical training work.

Remote sensing geology is an extremely technical line of work. Currently, the technical backbone force engaged in remote sensing geology work is mostly a group of geological technicians who have undergone short-term technical training. The insufficient number of technicians will become much more obvious as remote sensing geology applications and techniques develop, and their technical levels cannot meet the needs of development. For this reason, we should pay attention to intellectual development and adopt effective measures to strengthen technical training work. One measure is to continue running various types of training classes so that the current workforce of remote sensing geology personnel can improve their interpretation levels and fully understand new techniques and methods. There should be universal training in remote sensing geology techniques for regular geological personnel, and a group of technical personnel should improve their foreign language proficiency. A second measure is to replenish our ranks with talented young technicians in all areas, including those involved in geology, physics, geophysical exploration and computer techniques (primarily new college graduates and graduate students). A third measure is to establish more remote sensing geology courses in the related specializations in geology colleges and schools, so that all new graduates have a certain basic understanding of remote sensing geology. We should also gradually increase graduate student enrollments in areas of specialization related to remote sensing geology.

3. Replenish technical equipment, provide timely and high-quality remote sensing information.

Visual interpretation equipment is a form of technical equipment that is essential for developing work in remote sensing stations (groups). The principle for equipment allocation is usually that the authorized units themselves make the decision, and their specifications must be suited to real work requirements. As for certain not commonly used but indispensable medium-scale interpretation and processing equipment, etc, it can be allocated by related departments of the Ministry according to the principle of adoption, selection, and promotion over a large area. At the same time, we should also actively organize related units to develop and produce some common remote sensing and interpretation equipment.

We must strive to provide timely, high-quality remote sensing information. Before China's receiving stations are capable of providing satellite remote sensing data, we should purchase complete sets of satellite tapes for China for different seasons, process them into maps and provide them to each unit for use. For the black-and-white aerial photographs needed for regional survey and exploration work in each region and all out-of-date or overly small scale old photographs, we should organize and carry out high-resolution

aerial photography work at an appropriate scale (in cooperation with other aerial photography departments). At the same time, we should selectively do aerial color or color infrared photography and strive to gradually achieve the provision of data for surface work a year in advance.

4. Strengthen technical management work.

We must strengthen technical management work in remote sensing geology and gradually establish and perfect technical regulations for applications of remote sensing methods and a production technology management system. We should formulate or supplement the roles, procedures and technical requirements in regulations for geology work in the spheres of application. We should plan and actively organize many types of small-scale experience exchange meetings and on-the-spot investigation meetings. We must continue to organize the translation and publication of the most recent foreign works on remote sensing geology, strengthen S&T information and publication work, publish quality scholarly journals, develop academic activities, and continually improve theoretical and technical levels in remote sensing geology.

12539
CSO: 4008/136

APPLIED SCIENCES

INVESTIGATIVE REPORT ON USING GEOLOGICAL RESEARCH TO PROMOTE PROSPECTING

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese No 1, 1984
pp 15-18

[Article by the Science Education Office of the Jilin Province Geological
Bureau]

[Text] We organized an investigation group in 1982 which used 8 months' time to make thorough investigations of geological exploration institutes, prospecting engineering companies and nine of their subsidiary teams in Tonghua, Jilin, Yanbian, Siping, Changchun and other areas. We called investigation and discussion conferences with particupation by leading cadres, scientific and technical personnel and administrative cadres. They jointly summarized and explored questions of how to use science and technology (S&T) in geological prospecting. We will now report on the results of the investigation.

I. Integrated Geochemical Prospecting Requires Development of Specialized Research, Improved Prospecting Results

In its orientation toward geological prospecting and the questions and problems in geological work that urgently await resolution, geological scientific research should undertake specialized research and integrate prospecting with research. This can increase the level of research in geological work, and can improve the results of prospecting.

The No 2 Investigation Team (second-level team) of the No 4 Geological Investigation Institute (in Tonghua Prefecture) recognized the indispensable nature of doing research on ancient geography and climate in the search for mineral deposits during the process of evaluating gypsum deposits. They organized special research groups to undertake "research in ancient lithogeography." They made their first investigations in the Dongre, Xiasiping, Liuhaihui and other basins. They systematically collected hydrochemical samples and compiled a 1:100,000 scale hydrochemical map. They analyzed ancient geographic and climatic conditions, did research on lithic structure, facies zonal changes and facies surface characteristics and used this to make preliminary determination of gypsum-bearing indicator strata to guide hole placement during exploratory drilling in the mining region. Revealing the deep geological conditions in the mining region also provided specialized research with materials and data for observation and study, and led to a clearer understanding

of the geological environment of the minerals. From the selection of the specialized research topics and definition of the content of the research at each stage to the final demarcation of the four areas with prospective beneficial mineralizations at Xiasiping, Lujuanzi, Shangdianzi and Taiyangcha, they integrated investigation and research, and combined specific points with the larger area. This raised the level of geological research and improved the results of prospecting. Of the four prospective demarcated areas, minerals were found in two through exploratory drilling tests and verification. Exploration has been completed in our area, the Dongre mining area, which is a medium-sized gypsum deposit. In 1982, the provincial mineral resources commission did joint investigations and acceptance with industrial departments and design units. They feel that with a high level of research on this deposit the quality of prospecting will be high.

The example of the exploration in the Meng'entaoligai mining area fully shows that orienting scientific research toward resolving certain difficulties in geological prospecting is a route to raising the level of research in mining regions.

Meng'entaoligai is a large silver, lead and zinc deposit on which exploration was completed at the end of the 1970's. It also contains the useful associated elements copper, tin, gold, indium, cadmium, germanium, thallium, gallium and manganese. The prospecting team was unable to do research on so many associated elements at that time, so the provincial bureau organized the Geological Research Institute, Changchun Geological College and geological teams to jointly undertake a project for "Research on the Endowment Conditions and Distributional Laws of Silver, Lead and Zinc Deposits at Meng'entaoligai." After more than 2 years of fieldwork, they submitted a scientific research report in conjunction with the prospecting report. This raised the level of research on mineral deposits and supplied the prerequisite conditions for comprehensive utilization of mineral resources.

II. Synthesis and Collation of Data From Previous Investigations Permits Restudying and Reprocessing of Leftover Geological Problems and Is Also a Means for Gearing Scientific Research to Geological Prospecting

When exploration of a mining area is finished, even though a "final" prospecting report (of primary achievements) is submitted, it cannot be said that the geological phenomena and the geological laws of the area are fully understood. The "report" may leave behind various geological questions which require reanalysis (secondary achievements). This type of research can often be done a third or fourth time (research on the extraction process, for example). This type of research is definitely not simple repetition, however. It involves a higher level of research activity whose results can surpass those of the primary achievements in depth and width, and therefore has real use value.

In the mid-1970's, broad masses of S&T personnel did a large amount of hydrogeological investigations in the arid and semiarid regions of western Jilin. They completed reconnaissances of agricultural and animal husbandry water supplies and investigations of urban water supplies on various scales, and obtained a large amount of data. To solve this problem, the First Hydrology

Team carried out specialized research in the area in 1979 on hydrogeologic conditions in agricultural and animal husbandry water supplies, on evaluation and rational utilization of underground water resources over a large area, on hydrologic questions in improvement of saltwater and saline-alkali soils, on forecasting trends in underground water, on observation techniques and methods for underground water and other questions. In almost 4 years' time they also did the required geological field investigations and submitted a research report on "Underground Water Resources and Their Rational Utilization in the Songnen Plain in Jilin Province and the Liaohe Plain in Western Nei Monggol." After being appraised by the provincial science commission and the S&T Department and Hydrology Department of the Ministry of Geology and Mineral Resources, it was felt that project achievements in certain spheres had reached advanced national levels and could be submitted for use in production departments.

During the collation of thin-section data in 1979, S&T personnel of the central research office of the Jilin District No 2 Geological Investigation Institute discovered a suspicious clue in kyanite. They quickly stepped up on-the-spot surveys, field investigations and engineering exposures and later confirmed it was a kyanite deposit.

Regional geological prospecting work on a scale of 1:200,000 has basically been completed. Because of the limitations of technical conditions and knowledge at that time, many geological problems related to strata, rock, structure, magmatic rock and other areas have been left behind. This is definitely a basis for undertaking specialized research topics. Work has been carried out for years in the ancient strata of southern Jilin Province, for example. Fairly detailed differentiations have been achieved in Cambrian and Ordovician systems, and they have established stratum units for each group that are basically identical with those in the North China region. Serious research has not been done on the boundaries of the Cambrian and Ordovician systems, however. This has made it impossible to unite it with the boundaries of already surveyed sections. While summarizing the work of the 1:200,000 regional geological investigations, they also did specialized research on the boundaries of the Cambrian and Ordovician systems. With assistance from the Nanjing Paleobiology Research Institute and the Tianjin Geology and Minerals Institute, they did another survey of the primary sections in southern Jilin, collected large amounts of fossils and determined two fairly good boundary sections between the Cambrian and Ordovician systems. After examination and approval by specialists, it was felt that the selected sections were representative and provided abundant and reliable data showing that the boundaries they had designated between the Cambrian and Ordovician systems were basically correct and were of major significance for comparison of Ordovician systems in the north and south of the country. This scientific research achievement further intensified the 1:200,000 regional investigation work.

Time and effort can be saved by plotting 1:50,000 maps of mineralized regions and zones, and of areas around mining regions with a high degree of work and by adopting methods to integrate compilation and surveying. This deserves encouragement.

The Hunjiang Sifangshan-Banshigou Belt is an old mining area with a long history of geological work. There have been census explorations, geophysical and geochemical explorations and geological mapping on various scales since the 1950's. Over 10 large and medium mineral deposits and tens of smaller mineral deposits and areas of mineralization were discovered. Research should be done on plotting 1:50,000 maps of regions with a high level of work and on how to deal with previously achieved results and data. S&T personnel in the No 4 Geological Investigation Institute proposed a full set of work methods for integrating map compilation and surveying on the basis of summarizing experience and education for formal plotting of 1:50,000 maps. They were able to integrate the specific with the general, field investigations with comprehensive research and basic geological research with mineral prospecting. They achieved twice the results with half the effort. Practice has proven that this method for integrating compilation and surveying conserves large amounts of human and material resources, guarantees the quality of the maps, and reduces the time required to complete a map by one-half.

III. Opening Up New Spheres of Geological Work Requires Giving Play to the Advance Role of Scientific Research

The need for mineral resources will continue to increase following development of the national economy. The area of prospecting expands and the sphere of services grows broader. Geological work, for example, can play a necessary role in environmental geology, disaster geology, tourist geology, territorial geology, many types of engineering and other areas. Only in this way can there be dynamic geological work. Scientific research should be in the first line when opening up new areas of work.

The No 1 Geological Brigade (the Changchun Brigade) is an investigation and prospecting contingent of 600 people. After the 3d Plenary Session of the 11th CPC Congress, their deployment was readjusted and exploration for iron was changed into exploration for nonmetallic mineral deposits. The change in mineral types gave them many problems and they faced new prospecting tasks. S&T information personnel collected a large amount of information on domestic nonmetallic minerals, translated some foreign materials and documents concerning nonmetallic minerals and wollastonite and provided them to geological field personnel. This brigade's central research office undertook a research project on "The Mineralization Laws and Industrial Uses of Zeolite, Bentonite and Pearlite" that was assigned by the provincial science commission. In recent years, they linkedup with geological field investigations to make on-the-spot investigations of 699 mineral locations throughout the province and developed a systematic card registry of the geological conditions of each location. They also selected the better mineral locations for key dissection and did test surveys on 22 geological systems with a total length of 6.7 kilometers. They drew on some trench and shaft engineering [materials] and compiled a 1:500,000 provincial map of the laws of nonmetallic mineralization, designated eight prospective mineralization areas, and found eight locations for further geological work. The prospecting has now verified a large bentonite deposit and two wollastonite deposits. The S&T personnel of this office discovered dickite, alumstone and kaolinite at Malugou in Changbai County. It has now been confirmed that this is a promising mineralization area.

The S&T personnel of this office were not satisfied with searching for mineral deposits. They also did a lot of research on industrial uses. They strongly felt that nonmetallic minerals can become "ore" if they can be used. If they cannot be used, they are just a pile of waste rock and additional prospecting is useless. Thus, while they were doing research on mineral exploration, they also developed research on industrial uses of zeolite, wollastonite, bentonite, pearlite and kaolinite in cooperation with more than 10 domestic scientific research units, including porcelain research institutes, construction materials research institutes, light industry design research institutes, light industry bureaus and cement factories. Good results have already been obtained. Feedback from the cement plants has confirmed that a 15 to 20 percent increase in zeolite in the cement filler can raise the grade of the cement by 100 points. According to investigations in 13 medium and small cement plants in the province, there were 1.46 million yuan in profits in 1982 from this single scientific research achievement. There are 7 to 20 yuan in profits per ton of zeolite cement produced, and costs are 0.5 to 2 yuan lower than slag cement. Many small factories were able to turn losses into profits. Another scientific research achievement has confirmed that a 30 percent increase in wollastonite filler in glazed tile production can reduce the firing time by 40 hours, thereby reducing energy consumption and conserving energy. This achievement has already been used in production.

They have established relations with more than 90 factories, mines and scientific research units, opened consultation services for 13 factories and mines, and have also participated in professional consultations with foreign trade departments concerning exports of mineral products.

Environmental geology is a recently established new sphere of study. We should strengthen research work in this area and expand the scope of geological services.

Pollution in the Di'er Songhua Jiang has severely affected industrial and agricultural production and the people's lives. The Central Environmental Hydrogeology Station cooperated with environmental protection departments to solve this problem with a project on "Research on Underground Water Pollution and Its Prevention in Jilin City." The group of personnel given this topic made on-the-spot investigations of the industrial "three wastes" [waste gas, waste water and industrial residue] and on sources of pollution in agriculture and urban life. They studied the mechanics of widely distributed ground water with high concentrations of iron, manganese and nitrates and collected 770 water samples which provided 13,135 important pieces of data. They basically ascertained the water quality and the types, degrees and scopes of pollution for underground water in Jilin City. This achievement was used for evaluating the quality of underground water in Jilin City. They also proposed measures to prevent pollution and supplied valuable research data for urban planning and rational exploitation of underground water. This scientific research achievement gained a second-class award from the provincial People's Government in 1981.

IV. Integrate Geological Work Requirements, Widely Adopt New Technologies and Methods, Speed Up Progress in Geological Work

In 1978, the Ministry of Geology proposed important measures for developing five major technologies (geophysical and geochemical exploration, tests, remote sensing, electronic computing and small-bore diamond drilling). After 5 years of practice, it has been proven that this is totally correct.

Small-bore diamond drilling has undergond 7 years of experimentation and extension. The overall effect has been higher productivity, better quality, lower costs and lower labor intensity. It has received universal praise from workers, engineering and technical personnel and geological personnel. It has ended the cessation of drill effectiveness at around 300 meters that had been the case in our bureau for a long period. By the end of 1982, the drill effectiveness of the bureau's small-bore diamond drills reached 617 meters, while that of wire-line coring drills reached 694 meters. These are, respectively, 8.6 and 22.1 percent higher than the drill effectiveness of 568 meters in the Soviet Union in 1981. This great increase in drill effectiveness has shortened census evaluations and exploration cycles. According to investigations in four mining areas, for the Baoquan Lianhuashan Copper Mine (the work) was shortened by 2.8 years, at the Yongji Taodaogou Pyrrhotite Mine by 1.8 years, at the Tonghua Chibansong Nickel Mine by 0.5 years, and at the Piaohechuan Nickel Mine by 1.9 years.

It was learned from summaries of data over the past 30 years that drilling effectiveness was greatly increased after each achievement in developing new abrasives was used in drilling production. For example, iron sand is 42 percent more effective than common alloy drills, steel shot is 44 percent more effective than iron sand, and diamonds are 87 percent more effective than steel shot. This effectively proves that development of production must depend on S&T advances.

Excellent results have been obtained using remote sensing techniques in regional geological investigations, mineral censuses and searches for interstitial crevice water. Using interpretations of aerial and satellite photographs for 1:200,000 regional investigations can reduce field measurement lines, guarantee mapping precision and shorten the map plotting cycle. After this, they began experiments in the two regions with 1:50,000 scale maps at Jiaohe Hengdaozi and Hailong Xiaoyangshuhe. The results showed that certain benefits were obtained through differentiation of mapping units and research on some geological questions. There was a 75 percent correspondence between interpretations of specific places and on-the-spot investigations. Research has led to a preliminary feeling that aerial photographs could be used in 1:50,000 geological investigations. They can reduce a portion of the lines of investigation and can guarantee map quality and research levels.

There have been two major breakthroughs from using remote-sensing techniques while searching for water-bearing fracture zones in commodity grain base areas. After discovering underground water with a single well pumping capacity of 30 tons per hour at Dahuanggou in Yushu County in 1980, they also found an artesian well with a round-the-clock pumping capacity of 595 tons and a 3-meter head at Xiaoquanyan'gou in Lishu County in 1982.

V. Some Points of Knowledge

1. The choice of scientific research topics should begin with the actual requirements of geological prospecting, resolve difficulties and problems in geological prospecting and achieve the integration of scientific research and prospecting. Only in this way can we give play to the advance role of scientific research. Research topics that are detached from reality will not achieve useful results.

2. Within a single province, there should be a search for the proper ratio between basic geological research and applied research. There should be unified arrangements, organization of the appropriate forces and attacks on key problems for the basic theoretical and prospecting problems encountered in geological prospecting work to achieve breakthroughs in both theoretical and practical aspects and open up a new situation in prospecting.

3. Research on mineralization theory is important, of course, but we cannot neglect scientific research on technical methods and prospecting measures. Research on new technologies and methods and their application can provide prospecting information, speed up censuses and exploration, shorten the prospecting cycle and improve economic results.

4. The organizational form of scientific research should be determined after considering the needs of prospecting and scientific research work. We should not adhere rigidly to one model. In the current stage of organizational reforms, we must be even bolder in practice to explore new forms of organization that are adapted to the needs of scientific research. We must not force the use of a certain form or restrict other forms, since this does not benefit the development of S&T work.

12539
CSO: 4008/138

DISCUSSION OF GEOCHEMICAL EXPLORATION FOR GOLD ORE

Beijing WUTAN YU HUATAN [GEOPHYSICAL AND GEOCHEMICAL EXPLORATION] in Chinese No 6, 1983 pp 381-382 and 333

[Commentary by Sun Huanzhen [1327 3562 2182] and Mou Xuzan [3664 4872 6363] of the Geophysical and Geochemical Exploration Bureau, Ministry of Geology and Mineral Resources: "A discussion of Several Questions in Present Geochemical Exploration for Gold Ore"]

[Text] Gold ore is among the mineral resources most urgently lacking in the country. Geological, metallurgical and other ministries in China are currently investing major efforts and applying many different methods to develop gold ore prospecting and exploration work.

In recent years, more than 10 geological and mineral resources bureaus under the Ministry of Geology and Mineral Resources have utilized geochemical exploration methods to undertake regional investigation and prospecting for gold ore. More than 10 new gold ore deposits have been discovered, and fairly good results have been obtained in geological prospecting. However, there are still several problems which need exploring.

This article will discuss several questions in current work in geochemical prospecting for gold ore as we understand them:

I. Geochemical Prospecting for Gold Ore Should Adhere to the Principle of "Regional Deployment, Key Breakthroughs"

As we understand it, the best achievements were mostly obtained by adhering to this principle. For example, the Henan Geology and Mineral Resources Bureau has completed regional exploratory surface scanning work concentrating on gold at the scale of 1:200,000 on about 4,000 km in the Qinling area in the past 2 years. After preliminary investigation of abnormalities, they derived nine areas of gold abnormality on a certain scale. Among them, apart from two areas of abnormalities which were caused by known gold ore seams, all of the remaining seven areas of gold abnormalities are prospective areas for exploration which were not previously understood or only slightly understood. After screening and comparison, it was felt that at least two of the areas are of major importance for ore prospecting. In this way, the long-term situation of a lack of clarity in the direction to take in this survey region

in prospecting for ore and where to begin has been transformed. The work in this phase involved just four sampling teams (eight people) and 6 months' time to complete sampling and sample-processing tasks. Analysis of the gold was completed in just over 2 months. Another example is the Xiongershan region of Henan. Since 1964, eight or nine units undertook geological investigations, but the situation from beginning to end was like a "sky full of stars with no moon to be seen." In 1979, the Henan No 1 Geological Investigation Team carried out a 1:50,000 hydrographic sediment survey over a 1,470 sq km area at the northern foot of Xiongershan. They discovered four gold abnormalities. After screening and evaluation, they decided to do a 1:10,000 soil survey of the No 6 gold abnormality at Shanggong in Luoning County. After engineering tests and verification, they discovered a large gold ore seam at Shanggong. Successful ore prospecting of this type was achieved by units such as the materials exploration teams of the Hunan and Gansu Geological and Mineral Resources Bureaus. This shows that this definitely gives full play to the superiority of geochemical prospecting methods, which can investigate a wide area to eliminate large regions with no prospects and focus attention on target areas with prospects for discovering ore, thereby achieving twice the results with half the effort. There are, however, geological teams and materials exploration teams in some provinces which have not adhered to this principle. They have carried out long-term geochemical explorations and sampling investigations using intensive sampling based on certain fragmentary geological data or materials exploration data over an area of only a few dozen square kilometers or even a few square kilometers. However, they do not understand and have done no research on the special geochemical characteristics of the mineralization of gold throughout a prospective region. This method seldom easily achieves good results, and often becomes bogged down in a situation of being unable to make breakthroughs in ore prospecting for a long time.

II. Questions Related to the Selection of Indicator Elements in Geochemical Exploration for Gold Ore

Because of the complexity of the methods commonly used for spectral analysis of geochemical prospecting samples in techniques for determining trace amounts of gold, geochemical exploration for gold ore in some provinces still uses arsenic, silver, antimony and other elements associated with gold ore as indicator elements. An examination of existing data shows that while using indirect indicator element methods can sometimes suceed in finding ore, sometimes no results are achieved. The latter case is most common in investigation and prospecting work over a large area. Because the elements associated with gold ore sometimes are very complex, good results are seldom obtained by just determining the associated elements. In a gold ore field at Xiaoqingling in Henan, for example, there are substantial dissimilarities in the composition of associated elements in an area of gold abnormalities over 300 km. There are fairly good molybdenum abnormalities in the southern ore belt and strong silver abnormalities in the central ore belt, but there are low background levels of arsenic in the region of gold abnormalities. Fairly good results in ore prospecting have usually been obtained in recent years by using gold as a direct indicator element and reducing detection limits to 0.001 grams per ton. This is because gold ore often is produced in

the form of natural gold. As an indicator of geologic origin, natural gold is a fairly stable ore which is unlikely to have been dissolved away. For this reason, it often forms a secondary dispersion halo or flow over a large surface area. The surface scattering caused by the Xiaoqinling gold field mentioned above may cover as much as 300 sq km, while the area of abnormality for copper, lead, zinc, silver and other elements is much smaller in scope than that of the gold abnormality. The secondary halo of gold from the Shang-gong gold seam in Luoning County covered an area of 27 sq km, while the secondary haloes of silver and copper were much smaller than the gold. For this reason, using gold as an indicator element not only can directly reflect the mineralization of gold, but can also make use of scattered sampling densities to reduce the amount of analytical work without missing the target. Gold suffers from little interference when it is used as an indicator element. As soon as a gold abnormality of a certain scale is discovered, it can usually be considered to be a direct reflection of a gold seam or gold mineralization. Moreover, because of the relative stability of gold under the conditions of its original formation, it is usually possible to derive a more reliable estimate of the prospects for gold mineralization based on the concentration and area of the gold abnormality than by using other indicator elements.

III. Problems of Measuring Trace Amounts of Gold in Geochemical Exploration for Gold Ore

Techniques for measuring a gold concentration in samples as low as 0.001 to 0.0003 grams per ton must first be understood in geochemical prospecting for gold ore. Otherwise, success will be unlikely. The main methods for measuring trace gold that are currently used in geochemical prospecting for gold ore are: 1) Chemical spectrum measurements methods[1,2]; 2) Atomic absorption flame measurement methods[3]; and 3) Atomic absorption no-flame measurement methods. Practice in all areas has proven through comparison of these three types of methods that chemical spectrum measurement is the best in several areas, including the lower limit of detection, precision, accuracy, work efficiency and the conditions of instruments and equipment required for the method, and is better adapted to the current equipment conditions and geochemical exploration work requirements of most field teams in China. This method can report fairly reliable analytical data on gold at concentrations as low as 0.001 to 0.0003 grams per ton (1 to 0.3 ppb) in geochemical exploration samples. The instruments required for this method are not to difficult to obtain. Work can begin with only a domestically produced 1-meter raster spectroscope and some conventional laboratory equipment. If work efficiency is such that 3 people using 1 unit for 1 shift (8 hours) can complete measurements on trace amounts of gold in 50 to 60 samples. Its use has now been extended to field teams in over 10 provinces throughout the country. According to our understanding, most of the better results in finding ore that have been obtained in geochemical prospecting for gold ore were obtained using this method.

IV. We Must Pay Attention to Gold Ore Deposits Produced as Ultramicron Natural Gold

The ministry has discovered two gold ore seams of this type: 1) The Miaolong gold ore seam in Guizhou, which has natural gold within arsenopyrite. The particles range from 1 to 3 microns and the ore body appears in a Sinian stratum; and 2) a certain area in Guizhou where natural gold appears in arsenopyrite ore and clay minerals. The particles range from 0.01 to 0.06 microns and the ore body was produced in a Triassic stratum. These two types of gold ore are indiscernable with the naked eye or under a microscope, and usually cannot be discovered using traditional heavy sand methods. Geochemical exploration methods are the only currently effective means of searching for this type of ore deposit. The Miaoling gold deposit was found after engineering tests and verification of data provided by geochemical exploration. We should, therefore, pay attention to using geochemical prospecting methods to search for new gold deposits of this type.

One other question which should receive attention is measurement of trace amounts of gold during explorations for nonferrous metal ore deposits or in drill cores for explorations that have already been finished.

V. Questions of the Lower Limits of Detection and Precision Required for Measuring Gold in Geochemical Prospecting Samples of Gold Ore

Based on existing data, there are different requirements for the lower limit of detection of gold at different work stages (see Table 1).

Because most gold occurs in the form of natural gold which is difficult to crush during the processing of samples, the gold will be unevenly distributed through the sample. Thus, if we wish to achieve fairly precise analytical results, at least 10-gram samples should be collected for each analysis. Those who have experimented with sampling amounts feel that the most satisfactory precision and accuracy is obtained in samples of 20 grams.

The required level of precision and detection methods for measuring gold in geochemical exploration samples of gold ore are shown in Table 2.[4]

Methods of Checking Precision: From the basic results in each group being analyzed, reanalyze a sample which is at least 10 percent of the whole sample. The samples chosen for reanalysis should include some which are of completely high and partially medium and low concentrations. The relative error between the results of reanalysis and the results of the basic analysis is calculated according to the required statistics shown in Table 2. When analyzing 20 gram samples, at least 90 percent of the total number of samples checked should meet the requirements. When analyzing 10 gram samples, at least 80 percent of the total number of samples checked should meet the requirements.

Table 1. Lower Limits of Gold Detection for Each Stage of Work

Stage of Geochemical Prospecting	Scale	Required Lower Limit of Detection for Gold
Regional geochemical prospecting	1:200,000 to 1:100,000	0.3 ppb
Census geochemical prospecting	1:50,000	0.5 to 0.1 ppb
Detailed geochemical prospecting	1:20,000 to 1:10,000	1 to 3 ppb

Table 2. Relative Error Required

$$RE\% = \frac{A - B}{\frac{1}{2}(A + B)} \times 100$$

Concentration Range (ppb)	Relative Error Required (RE)
0.3 to 10	RE $\leq$ 100 percent
10 to 500	RE $\leq$ 66.6 percent
$>$ 500	RE $\leq$ 50 percent

REFERENCES

1. Chen Shaoren [7115 4801 0088], Latoratory of the Nenan Geological Bureau, "Methods of Chemical Spectrum Measurement of Trace Amounts of Gold in Chemical Exploration Samples," WUTAN YU HUATAN [GOEPHYSICAL AND GEOCHEMICAL EXPLORATION], No 2, 1980.

2. Jiang Jianhua [5592 1696 5478], Ma Zhongguang [7456 6850 0342], and Chen Fanglun [7115 2455 0243], Laboratory of the Henan Provincial Geology Bureau, "Chemical Spectrum Measurement of Ultratrace Amounts of Gold," YANKUANG CESHI [ROCK AND ORE TESTING], Vol 1, No 2, 1982.

3. Deng Shirong [6772 1102 2837], "Methods for Rapid Measurement of Trace Amounts of Gold in Geochemical Exploration Surface Scanning Samples," WUTAN YU HUATAN, No 2, 1982.

4. "Summary of the Gold Ore Geochemical Exploration Report-Back Conference," Internal Data of the Physics and Chemistry Bureau, Ministry of Geology and Minteral Resources, 1983.

12539
CSO: 4008/139

POLICY DECISION TO IMPORT SCIENTIFIC, TECHNICAL EQUIPMENT NOTED

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese No 1, 1984
pp 7-10

[Article by Cao Ren Lin [2580 0088 2651]]

[North China College of Petroleum Design]

[Text] I. Introduction
Possession of advanced scientific and technical equipment ia a hallmark of the modern laboratory. While China can rely to some extent on internal production of advanced instrumentation and equipment, it must also import these from developed countries. At present, there are only 40-some plants in China which produce large-scale advanced instruments; and, due to the limited quality and precision of their optoelectronic systems, these are far from being able to fulfill our requirements for scientific research and industrial development. Therefore, we annually import apparatus and equipment in quantity. Practice has demonstrated that the importation of modern science and modern industrial technology is a shortcut to the development of China's economy, science and technology.

Petroleum exploration has been opened up to continuous development, and the regulations dealing with research on petroleum production and transport will ensure the expansion and increase of our petroleum reserves. Under these new conditions, our petroleum industry scientific research college, due to the increased attention and support of higher level responsible departments, has for several years now spent large sums of foreign exchange on the importation of relatively advanced instruments and equipment, in order that our scientific research will attain a level of quality.

Speaking of our college, in the several years since it was established, we have imported during that time various types of precise geologic instruments: infrared and ultraviolet spectroscopes, oil shale analyzers, atomic absorption spectrometers, electronic computers and other kinds of precision instruments and equipment--112 items in all. Of these, 78 were instruments used for surveying, testing and appraising, at a cost of about 4 million yuan. To date, the status of these instruments can be separated into three categories: first, 54 items of equipment, or 69.2%, can be considered as satisfactory; second,

17 items, or 21.8%, lack replacement parts or have developed various malfunctions due to aging; third, there are 7 items, or 9%, which are basically useless due to either being the wrong model, of poor quality, or have defects which we lack the means of repairing. At present, the most noticable problems with imported equipment are that their rate of use is not high, and their damage rate is uenven. In some units in China, these are widespread and old problems.

For the past several years, in accordance with the opeining up of scientific research work, there has been increased emphasis on using scientific methods to strengthen the management of laboratory equipment. How to bring imported instrumentation and equipment to fullest efficiency has become an urgent problem awaiting solution for leaders at all levels and for scientific managerial personnel.

A policy decision is the selection of a course of action; the course of action is the implementation of the policy decision. Just at the U.S. economist (Simon) has said: "Management is deciding policy. When one is not making policy decisions then one is implementing policy decisions." In setting up modern laboratories, how to properly and rationally integrate the realities of the situation with imported equipment in carrying out policy decision--this is of the greatest significance.

II. Blindly Importing Can Bring Negative Results.

Concerning technical imports, one must first look at the technical results; second, one must consider the economic benefits; these are not matters to be taken lightly. In the present work of importing technology, we see some units' policy makers, who, provided they have the foreign exchange, will often place an order and blindly import something, even under conditions of incomplete preparation. This makes negative results unavoidable, and the goals anticipated from importing technology impossible to attain. The kind of negative results seen are:

1. Because the technical properties of an instrument or piece of equipment are inappropriate, making it of no use in the unit's scientific research or production, so it becomes surplus. However, the unit does not for a time want to transfer the equipment to another unit. In 1978, my college imported from the Hitachi Company of Japan an automated amino acid analyzer, at a cost of 176,450 yuan. This type of instrument has so far been suited only for physiological testing, with no apparent use in petroleum geology. And, although this item of equipment has passed through several changes of personnel, there has still been not use found for it, and it is now in storage. And this is but one illustration. Again, in 1976 my college imported from Hungary a high-pressure synthesizer, costing 18,176 yuan, and from the day it arrived till now we have not even opened the box. This type of equipment is suited for high-pressure synthesis of chemical materials, but it is essentially useless in our unit. This is also an obvious example.

2. The level of translation from foreign language technical manuals is poor, so that after the equipment has arrived, for a long time the technical manuals cannot be translated and there is no way of installing the equipment or

debugging it. Because there is no way to have the technical manuals translated, some may have to wait six months or even longer. If after "exacting payment in time," it is discovered that replacement parts are missing, there is nothing to do but reopen trade negotiations, order another, at great loss.

3. Due to there being no organization with the power to allocate appropriate technology, and accordingly a lack of technically trained personnel, from the time instruments or equipment arrive, any problems which arise are handled in haste, with one or two key personnel being detailed to cope with them. Since operating personnel lack basic technical training, it is quite difficult for them to become really familiar with the equipment's system properties. Therefore, when these operators encounter small defects in the equipment they have no way of eliminating them. Equipment is often inefficiently operated, with resultant injuries.

4. The modern large-scale equipment that we import generally has complicated optoelectronic systems, program controls and microprocessing devices. This puts many stringent requirements on modern laboratories for not only capital construction conditions, but also for ventilation, dustproofing, soundproofing, shockproofing, antimagnetic, anticorrosive and air-conditioning equipment, plumbing, stable power sources, filtering equipment, standardized materials and various kinds of gas supplies, etc. Because policy makers have not understood the need for these special requirements, the result has been that after the equipment has arrived, the supplementary conditions have not followed. The saying, "without fuel or rice, the pot is useless," applies here, on the installation, debugging and utilization of instruments.

5. Because of the role played by the force of traditional small scale production habits, imported equipment is often widely dispersed among small or very small units; this is much like dividing one's forces for defense, each setting up its unique system. What some instruments are supposed to analyse is unclear. production missions are difficult to coordinate, and cooperative use cannot be arranged. The result is that in one unit people will fight over instruments, fight to get imports, as everyone wants the "high-grade, precision and advanced," the "small and complete," and "what ever the other fellow has." This reveals fully the contradictions in acquiring and using. Policy makers reconcile these contradictions by placing repeat orders on imports, thus exacerbating the mess.

It is common knowledge that in other countries usually two to three years are required for a type of advanced instrument or equipment to go from initial testing in a laboratory to becoming a commodity for export. After we have learned of it, have requested that an order be placed, and receive the item, another one or two years has passed. So for an advanced item of equipment to get into our hands requires three to five years. If we then add on the various reasons which prevent the immediate debugging or putting into operation of the equipment, we can see that this kind of bungling process has caused what was originally a modern item to just lie in its box, tiding over its "Spring Period," and very rapidly become outmoded.

According to statistics, modern scientific and technical knowledge doubles

every 7 to 10 years. Along with these rapid developments in science and technology, new generations of instruments and equipment have come along fairly rapidly. Large precision instruments and equipment generally change models once in every 3-5 years. If we choose to import technology irrationally, that is, without planning or preparation, is that not a great waste of our precious construction funds! And how, then, can the world's modern technical equipment serve China's Four Modernizations?

III. Import Rationally, Absorbing and Bringing Forth New Ideas

To import rationally, it is crucial that policy makers take this as a very serious responsibility. They must seriously carry out advanced, pragmatic and consistent principles. Selection of equipment models should first of all be based on what is available internally, that is, whatever instruments or equipment produced in China are capable of being used should be utilized as fully as possible. This is because it is easier to supply replacement parts when the equipment is manufactured in China, and as the source of the consumer goods is abundant it is more convenient to buy replacements. Some items which are routinely used in analysis should even more be instruments for which a Chinese product is the specified design. Only if Chinese-manufactured instruments or equipment cannot accomplish the mission should imports then be considered.

Because there are so many kinds and models of instruments and equipment, when ordering it is necessary to not merely stress an item's novelty, high level of precision, or degree of automation. The item must have a definite purpose, and above all its utility must be stressed. It should be judged from an economic viewpoint, so that by every possible means China's precious foreign exchange is conserved.

Precision instruments and equipment are very advanced technically, with complex structures, and require many compatible auxiliary components, therefore, before importing some items of technical equipment, policy-making personnel should at an early point organize the capability of making a detailed demonstration of the items' technical ability and utility value. Above all, they should have a sample of the advanced equipment, whether foreign or domestic, in order to understand its level of development, its tendencies and technical requirements, thereby ensuring that the imported equipment is advanced, reliable, appropriate and useful.

After the equipment order has been approved by the responsible Chinese units, close attention should be given to providing and training technical cadres. At the same time, it is necessary to prepare the supplementary conditions required by the equipment, so that the research mission, research personnel, instruments and equipment are unified into a complete whole.

After the equipment has been received, the box should be opened at once, and the equipment inspected before acceptance. It is most important that during the warranty period the equipment be turned on and operated. If qualitative or quantitative problems are discovered, then a report should be written concerning the opening of the box and the checking, and damage claim procedures

should be initiated immediately. As for absorbing the technology and creating new instruments, that is a time consuming process. This is to say, after importing instruments or equipment, within a short time after the equipment is operating or in use, technical personnel shoud be adept at their jobs and familiar with the equipment's technical characteristics and chief properties. Afterwards, they shouldthen be able to combine practice with needs by appraising and modifying the equipment, thereby increasing its technical precision and expanding the scope of its utility. If there are needs, then there should be coordination with the plants which manufacture scientific research instruments and equipment, in order to bring about a synthesis of ideas. This will also fill in the gaps, and develop new applications for the equipment, explore new technical theories, and train new specialist manpower.

Experience has demonstrated that becoming expert at absorbing and digesting the accomplishments of foreign science and technology requires more than just investing large sums of money; it also requires that the process of technical development be shortened, and that the nation's growth to scientific and technical maturity be accelerated.

Japan, following World War II, decided upon a policy of "building the nation on a technological base," and with a great deal of recommended foreign advanced scientific and technical accomplishments, proceeded to assimilate, remold, develop and export. By the beginning of the 1970s, they had gone from a frequently collapsing economic system to one that had leaped past Great Britain, France, and West Germany, to become the world's No. 2 economic superpower.

In the old China, the Yong Li Chemical Company took only 20-some years to successfully establish the Chinese people's basic chemical industry. Going from having to import foreign advanced technology to a position of exporting advanced technology was a technical accomplishment which shocked the nation and the world.

There is an example from my own college which I could note: at the end of 1981, we imported from France a pyrolitic chromatograph at a cost of 96,073 yuan. Because we were fully prepared, had selected an appropriate model, and above all provided technical cadres who had definite practical experience, the equipment passed smoothly through its acceptance check and debugging. From February 1982, when it was officially put into scientific production, to the present day, it has already tested nearly 2000 specimens, providing a scientific data for determining types of fresh oil shale and degree of maturity of its organic matter.

Our college also imported from a Japanese electronic company a computerized chromatic mass spectrometer, at a cost of 777,660 yuan. Since March 1979, when it was debugged and put into production, it has analyzed 1800 specimens. According to a scholarly article published by our scientific personnel, it has distinguished over 50 organic compounds, of which 31 were reported for the first time in China. The chromatic spectrometer appraises crude oil and oil shale for organic compounds, thereby not only supplying advanced quality

parameters and abundant shale theories, but also creating the conditions for our petroleum industry to overtake and surpass the world standards of advancement. For this reason, our college has imported infrared spectrometers, medium-sized spectrographs, a reflecting-polarizing optical microscope and other equipment, all heavily used and developing definite purposes in petroleum geology. Naturally, it is still necessary to point out that the above-mentioned instruments and equipment imported by our college have as yet produced positive benefits only in the sense of "use." If we wish to progress in abosrbing the technical points of advanced equipment, linking practice with improvement, that will still require considerable effort.

IV. Cooperative Use Will Maximize Instruments' Utility

Effective management is not only an important reason for a developing science and a prosperous economy; it has also become an economic resource. In management, tapping potential outlets is an important way to maximize the utility of instrumentation and equipment.

1. Establish instrument testing centers.

In order to overcome the disadvantages of imported instruments and equipment, such as their isolation, dispersal, and low rate of utilization, and in order to avoid duplication of imports, it is absolutely necessary and feasible that we establish "instrument testing centers." The rationale behind this kind of management center is to foster expert equipment management and cooperative use. If plants have costly precision instruments or equipment which "can't get enough to eat," i.e., they are little used in fulfulling the plant's special needs, these instruments can then be sent to an "instrument testing center." This will liberate scientific research personnel from small production, and make it more convenient to serve the individual unit or area. In contrast, there must also be a balance struck between the centralization and dispersal of equipment, with an insistence on combining appropriate centralization with necessary dispersal. If the instruments' use does not match professional requirements, then some dispersal is likely. It is vital that this not be over-controlled, that all large-scale equipment not be concentrated in one place; otherwise, this would not be a "testing center." The nature of these "instrument testing center" is to emphasize service: they will be staffed with personnel engaged in research, production, management and maintenance, undertaking scientific research, production, testing and planning missions for the various units in their areas. They will correspondingly open up new technologies and new research methods. Scientific research personnel from the various units can send samples to the center for testing and obtain testing results from the center, or they can use the equipment to do their own testing, or they can engage in joint research projects with the center's personnel. Established "instrument testing centers" can first first carry out cooperative projects with their local colleges, institutes and units, and then, in accordance with their strengths and capabilities, expand to provide service on a regional basis, and even to outside, establishing close contacts throughout society and forming networks.

Regarding the management of cooperative service, there can be a combination of both planned and ad hoc arrangements. At the same time that scientific

managers are arranging a service plan, they can decide on a plan for cooperative instrument use. Science management departments can coordinate the negotiation and signing of agreements between consumers and "testing centers" for ad hoc service.

Economically, there must still be a method selected for handling the expense of checking and testing. This will on one hand replenish replacement parts and improve laboratory conditions; on the other, it could arouse the enthusiasm of scientific and technical personnel.

Practical experience both in China and abroad has demonstrated that the superiority of establishing "instrument testing centers" lies in: maximizing and modernizing the efficiency of testing methods; raising the utilization rate of instruments while reconciling the contradictions between needs and imports; partly overcoming the negative results created by blindly importing; and by decreasing waste and deriving the greatest benefits.

2. Organize and Set Up Elite Maintenance Units.

Virtually all the advanced large-scale instruments and equipment which we import has complex and precise optoelectronic systems and electronic circuitry. In order to ensure the equipment's functioning normally, it is absolutely essential that we organize and set up elite maintenance units. In the long run, these units will bear the responsibility of maintaining high-grade, precision, advanced equipment. This will avoid dependence on foreign commercial organizations or foreign technicians when equipment malfunctions. The members of these units would preferably be those who have several years of maintenance experience in the various units of local areas, and theoretically would be selected from technicians having high or farily high level expertise in radio and electrical maintenance.

After the maintenance units have been organized and set up, there should be a short period of training and practice, with a division of work responsibilities, until the personnel progressively attain a status of competence in their jobs. They can also contract for maintenance on a basis of particular industries or particular items of equipment, proceeding to undertake maintenance of large-scale, precision instrumentation and equipment on an area-wide basis, and, just like the maintenance of [business] scales, serve the entire area.

Within the limits of scientific management, there is still some work which should be brought up. If we lay down operating rules for instrumentation and equipment, set and perfect the technical records for this equipment, master the conditions for movement and maintenance of equipment, arrange for performance and precision checks at regular intervals, etc., this will all prolong the equipment's lifetime, ensure that the equipment will daily be at optimum technical condition, and will be an important way of maximizing efficiency. I hope that we will use the nation's limited foreign exchange to rationally import necessary advanced scientific and technical equipment, and by doing so make a contribution toward accelerating scientific and technical development in the petroleum industry.

12625
CSO: 4008/158

HARBIN'S SUBSONIC, TRANSSONIC WIND TUNNEL DETAILED

Beijing GUOJI HANGKONG [INTERNATIONAL AVIATION] in Chinese No 8, 5 Aug 83 pp 6-7

[Article by Wang Ruifu [3076 3843 1381] and Fan Jiechuan [5400 3381 1557]]

[Text] The Harbin Aerodynamics Research Institute recently completed technical modifications on its 0.52m x 0.64m subsonic and transsonic wind tunnel. The wind tunnel has been in operation since July 1982, during which time several thousand wind tunnel tests have been performed with satisfactory results.

The technical modifications include the following: for the first time the wind tunnel uses a test section made of a single-point support, semiflexible wall nozzle and slanted-hole walls with variable open/shut ratio or low-noise slanted-hole plates; a DJS-622 computer is used to control the wind tunnel operation and to perform automatic collection and real-time processing of test data; the test Mach Number can be varied continuously from 0.3 to 1.5 to provide an extended range for conducting low-supersonic tests, and an advanced test procedure for studying the wall characteristics of a transsonic wind tunnel...has been provided.

Main Features of the Wind Tunnel

This is a straight-flow, atmospheric-intake, subsonic and transsonic wind tunnel powered by three WP-5 engines. Its exterior profile is shown in Fig. 1. The dimensions and main features of the modified wind tunnel are summarized in Table 1. The height of the single-point support, semiflexible wall nozzle can be varied by a computer-controlled step motor, so that the nozzle shape can change from a converging sonic nozzle to a converging-diverging Laval nozzle. Through computer control, the open/shut ratios of the four slanted-hole walls or the low-noise slanted-hole walls can be varied continuously within the range of 0-9 percent; the variations can be either synchronous or asynchronous among the four walls, and can be controlled to an accuracy of ±1 mm. The test Mach Number is adjusted by using a computer to control the height of the nozzle throat, the engine speed, and the opening of the by-pass valve; the control accuracy of the Mach Number is 0.004. The attitude angle of the test model can be varied by a computer-controlled step motor to an accuracy of ±1'.

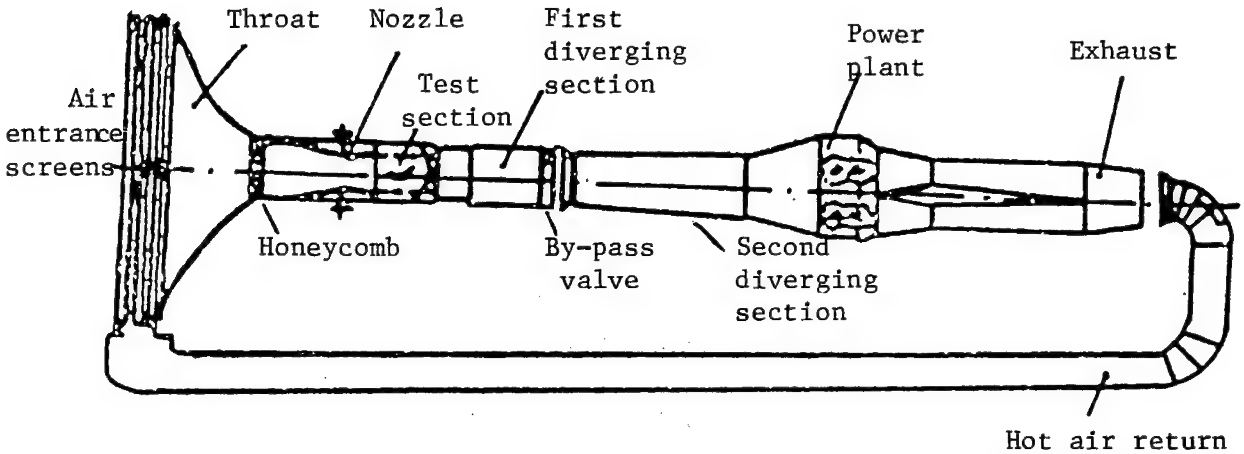

Fig. 1. Profile of the 0.52m x 0.64m Subsonic and Transsonic Wind Tunnel

Table 1.

Total length	(m)	39.5	Dynamic pressure (kg/cm^2)	600-4400
Test section cross section	(mxm)	0.52 x 0.64	Re x 10^{-6} *	0.5 - 1.0
Test section length	(m)	1.75	power plant	3 WP-5 engines @ maximum speed of 11,560 rpm to provide maximum dynamic pressure ratio of 1.72
Angle range of model		(1) α: ±15° β: ±6° (2) ±180°		
Mach number range		0.3 - 1.5	wind tunnel time	continuous

(1) Full-scale model
(2) Half-scale model
*The characteristic length of the Reynolds Number is defined as $0.1\sqrt{A}$, where A is the cross-sectional area of the test section

The wind tunnel is equipped with a Schlieren system with both an ordinary light source and a laser source which can take color Schlieren photographs; the wind tunnel is also equipped with a fluorescent oil flow field observation and illumination system.

After completion of the wind tunnel modification, the following tests have been conducted under various open/shut ratio conditions: flow field examination and measurement; force measurements on the GBM01 and GBM03 standard models; and pressure measurements on cone-shaped bodies. The results show marked improvement in the quality of the flow field, which satisfies the requirement of the domestic "Flow Field Specification for High-Speed Wind Tunnels"; this wind tunnel also has good wave-canceling characteristics (see Fig. 2). The maximum Mach Number of an empty wind tunnel has reached 1.58. The accuracy of force measurements on test models meets the domestic "Force Measurement Accuracy Specification," and the test curves are in good agreement with materials published in foreign literature and with domestic "standard curves."

Test Data Collection, Processing and Control System

The wind tunnel system has a test data collection, processing and control system centered around the DJS-622 computer, as shown in Fig. 3. The system uses a computer program written in the "BASIC-II wind tunnel test language" to perform wind tunnel operation control, automatic collection and real-time processing of test data. It is highly automated. The test curve can be displayed in real time on a graphic display unit. The operation parameters can be displayed in digital form on the control console. The processed test results can be printed in real time on a line printer, or plotted via a X-Y function recorder. The overall data processing accuracy is 0.5 percent.

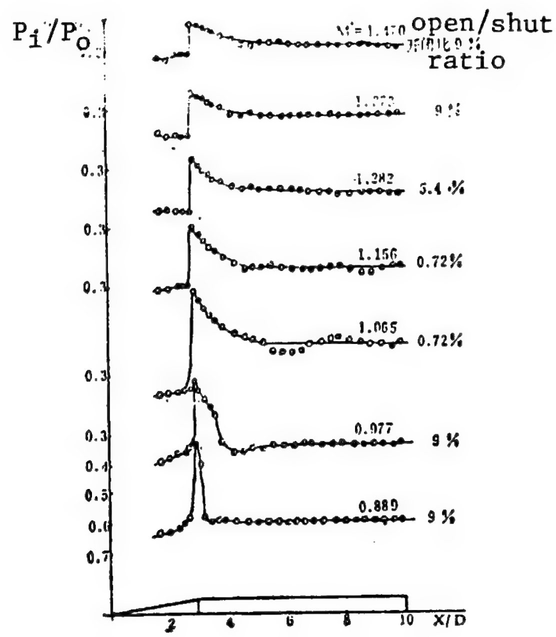

Fig. 2. Pressure Distribution Over a Conical Body (blockage 1.02 percent)

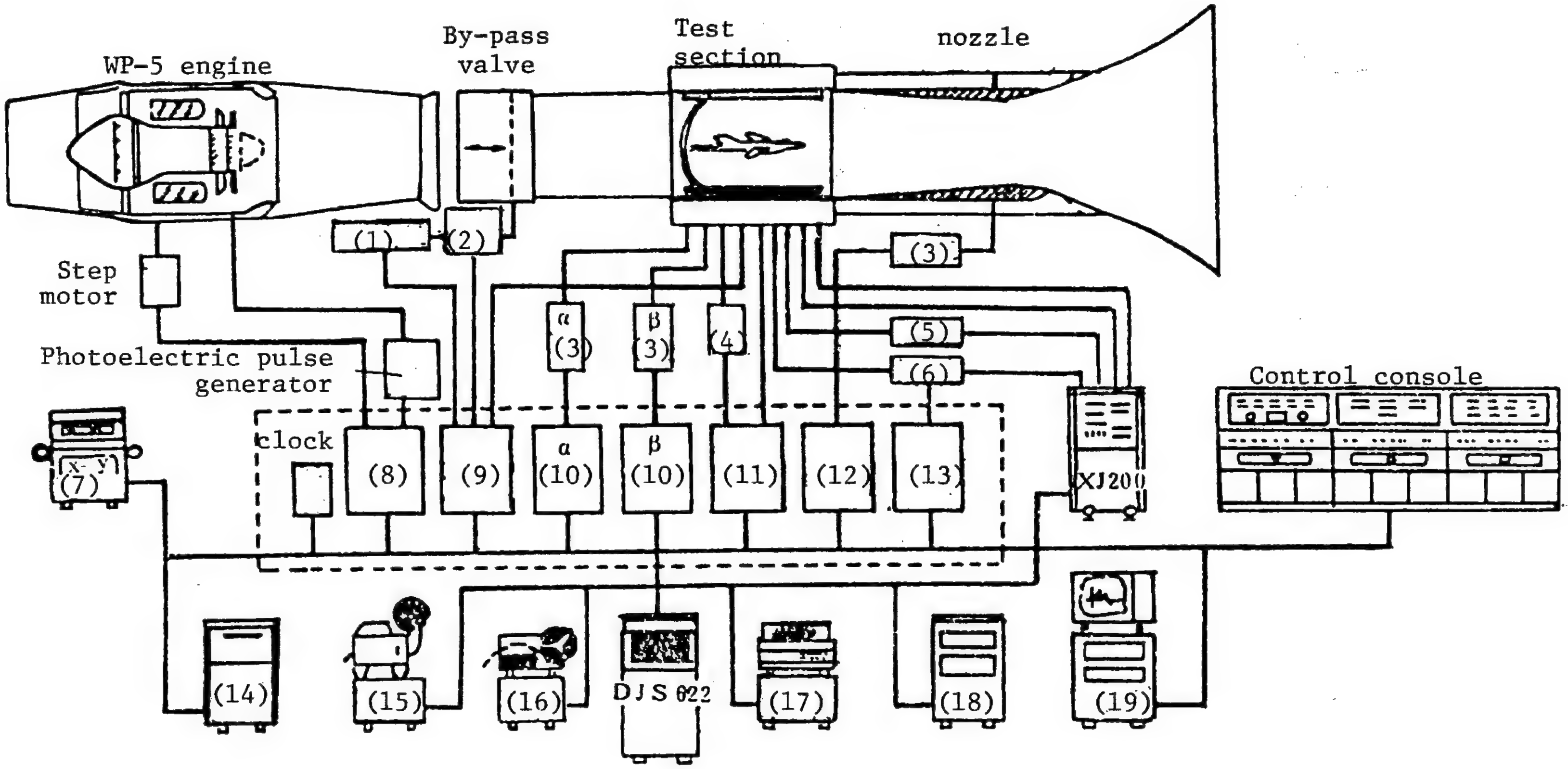

Fig. 3. Block Diagram of Test Data Collection, Processing and Control System

Key:

(1) velocity measurement generator
(2) d.c. motor
(3) step motor
(4) execution mechanism
(5) sensor
(6) scan valve
(7) X-Y recorder
(8) engine control
(9) by-pass valve control
(10) control
(11) open/shut ratio control
(12) flexible wall nozzle control
(13) scan valve control
(14) wide-margin line printer
(15) key punch
(16) paper tape input device
(17) control typewriter
(18) magnetic disc
(19) graphic display unit

The test data collection system includes various types of strain gauges with different resolutions and ranges, a pressure measuring system with pressure scan valves (the 48D8-1099H7M 48-point single valve and the 192-point valve group consisting of four 48D-8GM type I and type II single valves) and matching pressure sensors (PDCR-22PSI), the XJ-200 inspection device, the CYD-801A line printer, the LZ7-304 function recorder and a graphic display unit developed by the Research Institute. In data collection, the sampling period and the number of samples are selected based on the frequency characteristics of the interference signal; the results are averaged and smoothed to improve the data processing accuracy.

The control system includes the following subsystems: flexible wall nozzle control, model attitude (α, β) control, control of open-shut ratios of the walls, Mach Number control, engine speed control, as well as the warning system. Each subsystem can operate in a "joint" mode or in an "independent" mode. During wind tunnel operation, the subsystems are coordinated in time by the control program to function automatically.

The system also contains a wind tunnel test standard program and a strain gauge static calibration program. The static calibration results of the sensor and the strain gauge can be printed out on the line printer.

By using the highly automated test system, the control accuracy of model attitude angle and Mach Number as well as the data processing accuracy have been improved. As a result, the wind tunnel test efficiency has increased by approximately 50 percent over that before the modification, and the time required for data reduction has decreased.

Tests That Can Be Performed in the Wind Tunnel

1. Longitudinal and lateral force measurements on full-scale flight vehicles.

2. Force measurements on half-scale models.

3. Hinge moment measurements on full-scale or half-scale models.

4. Measurement of interference effects between suspended objects and fuselage.

5. Pressure measurements.

6. Air intake experiment.

7. Vibration tests.

8. Special experiments such as calibration of sensor characteristics.

9. Flow field observation tests.

In addition, new test equipment and techniques are being developed for this wind tunnel.

3012
CSO: 4008/204

APPLICATIONS OF ULTRASONIC TECHNOLOGY

Beijing YIQI YU WEILAI [INSTRUMENTATION AND THE FUTURE] in Chinese No 12, 1984 p 5

[Article by Ma Yunjie [7456 0061 2638]: "Various Applications of Ultrasonic Technology"]

[Excerpt] Ultrasonic technology is the study of the use of ultrasonic waves in production techniques and in related measurement techniques and instrumentation. Through ultrasonic generators, mechanical energy or electromagnetic energy can be converted into ultrasonic energy to produce the desired mechanical, thermal, optical, electrical, chemical and biological effects.

At present, ultrasonic devices are growing rapidly both in this country and abroad. Not only are they used extensively in industrial and agricultural production, medicine and health but also in people's daily lives. Some representative examples of ultrasonic technology applications are presented below.

1. Ultrasonic Cleaning

The intense vibration and vaporization effect generated by ultrasonic waves propagated in liquid can provide an effective and low-cost means for cleaning precision mechanisms and soiled fabrics. For example, the useful life of a Chinese-built textile spindle is approximately 5 years, whereas a Japanese-built spindle lasts 10 years. A close examination of the production of domestic spindles shows that it is difficult to clean certain complex parts thoroughly because cleaning is done by a high-pressure oil pump or by manual labor. The residual iron chips and debris which remain can cause damage to other components when the spindle rotates at 1,800 rpm and therefore may shorten its operating life. By using ultrasonic cleaning equipment to clean the spindles, the Shanghai Textile Machine Parts Factory increased the degree of cleanliness of the spindles and according to user feedback, the useful life of the spindle has been extended substantially.

Currently, ultrasonic cleaning devices are being widely used by manufacturers of watches, sewing machines, diesel engines and automobiles with outstanding economic results.

2. Ultrasonic Thickness Measurement

A Shanghai manufacturer has developed a high-sensitivity, easy-to-use miniature ultrasonic pachymeter which only weighs 580 grams. It has the unique capability of performing one-sided, nondestructive thickness measurements; it can provide accurate measurements of the wall thickness of ship hulls, pipes and high-pressure containers where it is not possible to touch both sides of the measured object simultaneously. As a result, this device can improve the safety of boilers, pressurized pipes and containers by detecting defects in advance.

3. Ultrasonic Depth Measurement

Another company in Shanghai has developed a shipborne depth finder which uses ultrasonic echoes. It is small in size, light in weight, easy to use and has an automatic warning device. During operation, the ultrasonic-wave generator located at the bottom of the hull transmits ultrasonic waves toward the ocean floor, and a reading of the water depth is shown on the digital display unit. The measurement range of the instrument is between 0.5 meters and 100 meters. When the ship travels to a shallow region where it is only 0.5-3 meters deep, the automatic warning device will sound an alarm so that the navigator can change its course in time to avoid a possible shipwreck. This depth finder can also be used to measure the water levels of reservoirs, docks, rivers and lakes.

4. Ultrasonic Welding

Ultrasonic welding, also called ultrasonic bonding, produces no electric arc, requires no welding flux and can maintain the same degree of purity of the welding material. It has been used extensively in semiconductor industries for bonding the internal lines of transistors and integrated circuits. The ultrasonic welding equipment currently available in this country includes the dual-power ultrasonic spot welder and the thermal ultrasonic gold-filament ball welder.

In addition, the ultrasonic welding technique has also been used to weld plastic materials. Such a technique requires only 0.5-1 second of welding time, is highly efficient and very clean and requires no adhesives; it also produces high-quality welds and can be easily automated. The Shanghai Thermos Bottle No 3 Factory used this new technique to solve the key problem in gas-pump plastic welding for producing pressurized thermos bottles.

It has been reported that a Swedish scientist has invented a button that can be welded on clothes. This button has a plastic strip on the back side which can be firmly "welded" on clothes with the use of ultrasonic techniques.

3012
CSO: 4008/149

APPLIED SCIENCES

BRIEFS

AMINO ACIDS IN METEORITE--Beijing, 24 Mar (XINHUA)--Chinese scientists have discovered amino acid compounds in melted meteorite ice, providing new clues to the possible existence of life outside the earth's atmosphere. The meteorite, estimated at 50 to 60 centimeters in diameter, fell on the east China city of Wuxi on April 11 of last year. The ice melted before scientists could reach it, but some of the remaining water was saved for research by a retired worker in the vicinity. The scientists said that if water existed in outer space, it was possible that life on earth may have originated from elsewhere in the universe. The discovery of amino acids in the meteorite ice also indicated that life could exist on other planets if conditions were favorable, they added. Analysis of the ice also revealed a greater density and higher mineral content than found in ice on earth. Amino acids are a basic component of protein and nucleic acid--the fundamental elements of life. [Text] [OW240200 Beijing XINHUA in English 0149 GMT 24 Mar 84]

CSO: 4010/68

'CONTEMPORARY CHINA'S STANDARDIZATION' EDITORIAL COMMITTEE ESTABLISHED

Beijing BIAOZHUNHUA TONGXUN [STANDARDIZATION JOURNAL] in Chinese No 11, 1983 p 5

[Text] On 16 September, the National Bureau of Standards held a conference in Beijing to establish an editorial committee for "Contemporary China's Standardization." The conference was chaired by Cheng Chuanhui, chief of National Bureau of Standards. Representing the bureau and the party, he announced that 27 experts and comrades who were either well known or had many years of experience in the field of standardization had been invited to form an editorial committee. Comrade Xu Haofeng would be the editor in chief, and comrades Zhong Ming and Dong Yaoxian would be the assistant editors in chief.

The conference lasted 2 days, during which time Xu Haofeng offered his opinion on how best to edit "Contemporary China's Standardization," reviewed the first phase of the job and discussed the concept of the overall editing task. The head of the editorial office, Han Zhaofang, gave a description of the editorial outline. A member of the editorial staff of the "Contemporary China" book series, Wu Jiaxun, also spoke on the topic of editing. The conference also reviewed the bulletins issued by the Central Propaganda Department on editing the "Contemporary China" book series and the comments made by Comrade Deng Liqun on editing "Contemporary China's Economic System Reform." It was generally agreed that a good editing job must contain the following elements: 1) It must be based on colorful and factual material; 2) it must reflect the unique features of standardization; 3) it must be logical and must derive systematic and general conclusions by analyzing the facts; and 4) it must combine the elements of history and theory. Based on these ground rules, the conference had extensive discussions on the editorial outline proposed by the editorial office of "Contemporary China's Standardization" and made several suggestions for a revised outline.

In addition to providing a plan for future work, the conference also encouraged the committee members to cooperate fully with one another, to collect information and to contribute ideas toward a better editing job.

The members of the editorial committee for "Contemporary China's Standardization" are listed below:

Editor in chief

Xu Haofeng	Consultant to the National Bureau of Standards NBS, originally deputy chief of the NBS

Assistant editor in chief

Zhong Ming	Deputy chief of the NBS
Dong Yaoxian	Assistant director of the Chinese Standardization Association, originally deputy chief of the NBS

Committee members

Wu Bowen	Assistant director of the Chinese Standardization Association, originally deputy chief of the NBS
Yang Jizhi	Consultant to the NBS, originally deputy chief of the NBS
Li Yuen	Chief engineer of the NBS, originally deputy chief of the NBS
Liu Gongcheng	Vice chairman of the Technology Committee of the National Bureau of Construction Materials
Liu Chuanxian	Deputy chief of the National Defense Science and Engineering Commission
Dai Hesheng	Director of the Chinese Standardization Research Institute
Ren Hua	Editor in chief of the Chinese Standard Publishing Office
Yang Sizhong	Director of the Bureau of Specification for Construction Standards of the National Planning Committee
Zhang Jiye	Director of the Bureau of Standards and Measures of Shandong Province
Gong Changfu	Director of the Bureau of Standards of Liaoning Province
Yang Jingyuan	Deputy director of the Bureau of Standards of Hubei Province
Shen Ruiyun	Deputy director of the Shanghai Bureau of Standards and Measures
Chen Wenxiang	Assistant chief engineer of the Office of Standardization of the Ministry of Machine Building
Li Xuefu	Consultant to the Office of Standardization of the Ministry of Metallurgy, originally deputy director

Lin Huixiu	Chief engineer of the Office of Standardization of the Ministry of Electronics Industry
Wang Ruxin	Senior engineer of the Bureau of Technology of the Ministry of Chemical Industry, originally head of the Department of Standards
Chu Zhanxu	Head of the Department of Standards, Bureau of Technology of the Ministry of Textile Industries
An Peihua	Head of the Department of Standards, Office of Production Technology of the Ministry of Light Industry
Song Jiafeng	Assistant head of the Department of Standards, Office of Technology of the Ministry of Farming and Fishery
Shao Bende	Head of the Department of Standards, Bureau of Environmental Protection of the Ministry of Urban Development and Environmental Protection
Yuan Shicheng	Chief pharmacist of the Committee on Pharmacy of the Ministry of Public Health
Huang Weijian	Head of the Department of Education of the NBS
Wen Songshan	Office manager of the NBS
Han Zhaofang	Manager of the Office of Coordination of the NBS

3012
CSO: 4008/149

MORE 'BAREFOOT DOCTORS' ACCREDITED IN SICHUAN

OW020834 Beijing XINHUA in English 0648 GMT 2 Apr 84

[Text] Chongqing, April 2 (XINHUA)--In China's most populated city [as received] of Chongqing, Sichuan Province, 2,800 more barefoot doctors have recently received certificates accrediting them as rural doctors.

Barefoot doctors appeared in China in the sixties. They are young peasants usually with a junior middle school education and some medical training. As paramedics they take care of the health needs of peasants in their own villages and also work in the fields.

In the past twenty years they have proved to be a vital part of China's rural medical and health network, taking care of treatment of common ailments, environmental hygiene, epidemic prevention and family planning. Efforts have therefore been made in recent years to upgrade their professional skills through retraining courses and a system of qualifying examinations.

The city government of Chongqing held an examination at the end of last year, and 2,800 people who had over ten years of practical experience passed to become rural doctors enjoying the same status as graduates of secondary medical schools.

Chongqing has a large rural population of over nine million scattered in 8,500 villages around the city proper. Besides these newly accredited rural doctors, there are 8,100 more paramedics and barefoot doctors as well as 14,000 medical aides and midwives.

In order to make the fullest possible use of all available medical personnel, Chongqing has recently approved the setting up of an association of retired medical workers. It now has 230 members in western or traditional medicine. The association plans to conduct medical studies and workshops, make proposals to the people's government on medical affairs, and run training courses.

The association has received funds from individuals and the government to buy two buildings for use as special clinics for the elderly and children.

CSO: 4010/72

ADVANCES IN STUDY OF COLD INJURY IN ARMY

Beijing JIEFANGJUN YIXUE ZAZHI [MEDICAL JOURNAL OF CHINESE PEOPLE'S LIBERATION ARMY] in Chinese No 6, 20 Dec 83 pp 469-470

[Article by Liu Enbo [0491 1869 3134]]

[Text] From 25-29 July 1983, the Fourth Symposium of the Army Cold Injury Specialty Group convened in Shenyang. Participating in the symposium were 46 specialists from the Academy of Military Medical Sciences; the Army forces in Shenyang, Lanzhou, Beijing and Urumqi; the Fourth Military Medical College; and specialty groups in various Navy and Air Force units. The symposium received 64 papers and documents on special topics, of which 31 were read in the general meeting. The symposium clearly demonstrated that the Army has made rapid progress in the prevention and treatment of cold injuries concerning the following aspects: factors for the prevalence, pathogenesis and treatment of severe cold injury, cold endurance physical training and cold prevention and heat preservation, etc.

Exploration in Factors for the Prevalence and the Pathogenesis of Cold Injury

1. Analysis of the Factors for the Prevalence of Cold Injury--The Army forces in the cold district have conducted several studies on cold injury. The basic law of occurrence established was similar to what had been reported before. However, group occurrences of severe cold injuries have become rarely seen. Only sporadic, mild cold injuries are more likely to occur. In a winter, the incidence of cold injuries is from 4 to 5 percent. Soldiers and members of the Army forces often lack cold endurance and are susceptible to cold injuries. With regard to individual factors, the studies have shown that birth place has little to do with the occurrence of cold injury. There is no apparent difference between the soldiers from northern provinces and those from the Central Plains provinces in cold injury incidence. Here we deviate from previous reports that have claimed a higher incidence of cold injuries among people from south of 35 degrees north latitude.

2. Explorations in the Injury Mechanism--There have been many theories concerning the way cold injures body tissues. The majority of the scholars regard the freezing-melting process as the basic cause of tissue destruction. The major pathological-physiological changes in the freezing-melting process is the injury to the metabolism of cells and the obstruction in the micro circulation. The two changes together damage the cells of the inner surface of

blood vessels. The effect of fast melting is to reduce the effective period of the harmful electrolyte consistency, thus alleviating the injury to cell metabolism and allowing the tissue injured by cold to survive. In our judgment, the effect of furacillin is not limited to disinfection; it can suppress the metabolic process of cells, thus slowing down the necrosis process of injured tissues. The treatment by repeated soaking in hibitane is further compared with other surface disinfectants to prove that the effect is not limited to disinfection only. Those herb medicines for antithermic effect, detoxication and the improvement of circulation, dissolving extravasated blood when used alone, often does not have much effect. However, when the medicine is used in combination with furacillin, the treatment effect is increased. The combined effect reveals the complex nature of cold injury pathogenesis. The Institute of Army Health of the Academy of Military Medical Sciences recently observed the degree of cold injury in relation to changes in certain biochemical indicators. The tests showed that after a cold injury the reduction in the amount of original muscle sugar is closely related to the degree of injury. The increase in the amount of DNA in the muscles is also closely related to the degree of cold injury. There were regular changes in the activity of the creatine phosphokinase in the serum. One hour after a cold injury, the activity rose considerably. The activity reached its peak 12 hours after the injury and started to decline after 24 hours. At 72 hours after the injury, the activity became normal. From studying the action mechanism of an effective medicine and the changes in biochemical indicators, we can further probe into the pathogenesis of cold injury, thus improving the early diagnosis, test, treatment and prognosis of the injury.

Research in Treatment of Severe Cold Injury

Tests showed that to treat severe laboratory cold injury to a rabbit's foot by soaking it 30 minutes each day for 6 consecutive days in 1 percent hibitane at 40°C, we can retain 60 percent of the injured area. The result has been notably superior to that using surface disinfectant or furacillin, which helped to retain approximately 30 percent of the injured area. The study showed that the superior result came because of the combined effect of warmth and the medicine xibitai rather than from the simple effect of disinfection.

Of all the studies on external medicine, people have for years been using 1 percent furacillin cream as a base to combine with the solution distilled from herb medicine which can reduce fever, detoxicate, improve circulation and dissolve extravasated blood to form a complex prescription cream, thus enhancing the effect of external medication for curing cold injury. In the Shenyang Army Institute of Military Medicine, repeated tests based on complex prescription selection confirmed the effect of the complex prescriptions of funanciwujia [furan-?: 069A 0809 0459 0063 0502] and of funandanggui [furan-?: 069A 0809 3981 2981] in treating cold injuries. Tests showed that the two complex prescriptions had retained, respectively, 45 percent and 40 percent of the areas on the rabbit's foot which had been soaked and injured in an alcohol solution at -20°C for 25 minutes. There were notable differences observed from the retained area of the control group and the group treated by furacillin. The reemergence quality following the complex prescription treatment is much better. In an Army hospital in Beijing, a superior result was

achieved using 805 complex prescription (not containing furacillin) in treating a cold-injured rabbit foot. The retained area is 10 percent higher than the retained area of an injury treated by furacillin alone.

In addition to the above-mentioned external medicine, in the clinical treatment of severe cold injury daily venoclysis of 500-1,000 ml, 6-10 percent low-molecular dextran can also be used in the early stage of injury. Anti-infective treatment can be administered at the same time.

Research on Method and Effect for Cold Endurance Physical Training

For 3 years, the army institutes of military medicine in Shenyang, Beijing, Lanzhou and Urumqi have conducted studies on cold endurance training through physical exercise, cold-water treatment, increased outdoor activities and comprehensive cold endurance training. Satisfactory results were observed from an evaluation of the physiological indicators and the incidence of cold-related diseases and from personal reports. A "Plan for Cold Endurance Training" which is suitable for Army use is being proposed.

1. Physical Exercises--When outdoor temperature is no lower than -20°C, soldiers are asked to run 5 km for half an hour 5 times a week for 6 weeks during morning exercise time, wearing flannel outfits and single-layer hats. The result shows that the cold injury incidence for those who have undergone the training is notably lower than those who have not. Training has improved their ability to maintain higher skin temperatures when their fingers are immersed in cold water. The temperature recovery speed is faster for those who have had training exercises and their hand skills for working in cold weather are notably improved.

2. Cold Water Training--Every morning the personnel undergo training by immersing their hands in cold water of 5°C for 10 minutes. After 4 weeks, the tests show that their skin temperature in cold water improves, the time needed for the hand temperature to return to normal after leaving the water is shortened, the reaction in blood vessel extension and contraction is faster, the high blood pressure caused by the cold disappears and hand dexterity increases while cold pain reaction reduces. Similar results are observed after 2 weeks when the subjects immerse their hands in cold water of 5°C for 30 minutes before they go to bed. However, we have not achieved the expected results in tests where feet were immersed in cold water.

3. Increasing Outdoor Activity Time--Tests show that if the average daily outdoor activity time from 4.6 hours to 7.0 hours for army troops in cold regions is increased, cold-related disease incidence is reduced notably. There is also a notable improvement in subjective feelings in cold environment. Hand dexterity is improved.

4. Comprehensive Training--The combined training of long-distance running and washing hands and face with cold water for 2 months has the following results: improved physiological function in heart blood vessels, lowered blood pressure during quiet periods, adaptative changes in oxygen consumption amount and cold pain reaction, increased nerve reflectivity and sustained higher level of temperature for skin when hands are immersed in cold water.

Research on Cold Prevention and Warmth Preservation

1. Studies on Cold Prevention Medicine--The Army Institute of Health of the Academy of Military Medical Sciences has successfully trial-manufactured a certain oral cold prevention medicine. When taken in an environment of -30°C, the medicine can raise the skin temperature of the toes by 7.3°C. The metabolism rate does not increase, and no sideeffects result. The Shenyang Army Institute of Military Medicine has made some observations concerning the effect of ciwujia [0459 0063 0502], huangqi (astragalus membranaceus) and wuweizi (fructus schisandrae) etc.--medicines which belong to the (?administered as solids?) category--on adaptability. The tentative conclusion they reached was that the medicine has the effect of increasing the cold resistance ability of the human body and the reaction ability of the blood vessels. There has not been any significant improvement in raising the temperature of terminal skin. The 403 Laboratory of the Fourth Military Medical College has observed the effect of ciwujia on the function and structure of liver chondrosome and has proved that ciwujia can increase the cold endurance ability of an animal organism.

2. Research on the Manufacture of Heat Generation Equipment--The chemical heat generation bag trial-manufactured by the Army Institute of Health of the Academy of Military Medical Sciences can generate a surface temperature of higher than 40°C. It can keep the warmth when placed on the body surface or in clothes. When not in use, the bag can be placed in an air-tight bag, thus terminating heat generation. The bag can be used repeatedly. The hand-held heat generator trial-manufactured by the Shenyang Army Institute of Military Medicine has a surface temperature of 60°C. It has achieved good results in the -28°C simulated testing ground for heat generation in evacuating wounded personnel from field operations. The field operation-style hot air machine trial-manufactured by an army hospital in Shenyang can be used in an operation tent in a field operation environment. Using the machine, the temperature in the tent can be raised quickly, oil consumption is little and a stable temperature is easily maintained.

3. Research on Heat Preservation Equipment for Wounded Personnel--The 82 model Cold Prevention Sleeping Bag trial-manufactured by the 52 Field Operation Hospital has good heat preservation qualities. A simulated test on wounded personnel in a -30°C environment on test grounds has shown satisfactory results. The heat preservation sleeping bag for wounded personnel trial-manufactured by the Institute of Health Equipment weighs 3.7 kg. When compared with the use of a blanket plus cotton comforter (weighing 4.9 kg) in a -30°C environment, the use of the sleeping bag is superior as demonstrated in the skin temperature measurement and the subjective reports of the subjects using the sleeping bags. In addition to the above inventions, the 251 Hospital has designed and trial-manufactured three kinds of boot covers for wounded personnel. The heat preservation quality as tested in actual situations is good.

4. Research on Winter Clothes Health Standards--The Institute of Army Health of the Academy of Military Medical Sciences has done systematic research on the heat insulation of current winter outfits and the heat preservation standards for winter outfits. Tests have shown that the current heat insulation

of cold-region winter clothing is 4.24 Clo, and that for the winter clothes in the north temperate zone is 3.60 Clo. From a determination of the winter clothing heat insulation, we can predict the environment temperature and the length the person in the outfit is able to endure. Furthermore, the Institute of Army Health of the Academy of Military Medical Sciences and the Navy Institute of Medicine have conducted a systematic hygienic evaluation of leather flying suits and cold-prevention and dampness-resistant flying suits to provide a scientific basis for designing, using and improving cold prevention outfits.

12453
CSO: 4008/152

END